SUPPLEMENT

To

MAINTENANCE MANUAL

Models

PD-3751 *and* PD-4151

GMC TRUCK & COACH DIVISION
GENERAL MOTORS CORPORATION
PONTIAC, MICHIGAN

Following are the pages of this supplement in which appear sectional revisions of Maintenance Manual X-4711.

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INTRODUCTION

Service information in this supplement, when used in conjunction with information given in Maintenance Manual X-4711, provides coverage for all current PD-4151 and PD-3751 coaches.

The information in this supplement is arranged under section headings which correspond with section headings in current manual (Form X-4711). All page references in supplement are to page numbers in current manual (Form X-4711).

Figure references in supplement which are followed by page numbers, are to illustrations in current manual. If figure reference is not followed by a page number, illustration will be found in this supplement.

Sections in Maintenance Manual X-4711 which do not require changing are not covered in this supplement. Sections which are changed are covered in this supplement. The table on page 4 provides a quick reference as to the status of each section in current manual (Form X-4711). Table should be consulted before using service information in current manual or in this supplement.

QUICK REFERENCE TABLE

The following table lists the names and numbers of the major service sections in the order in which they appear in the current maintenance manual (Form X-4711) and in this supplement.

This table also indicates which sections in manual X-4711 apply to both PD-3751 and PD-4151 model coaches without changes.

In addition, manual sections which require the supplementary service information given in the following pages, are also indicated in this table.

SECTION NO.	SECTION NAME	FORM X-4711	PAGE NO. IN SUPPLEMENT
	Model Data	7*	-
1-A	Front End Alignment	29 - 32 (†)	4
1-B	Front Axle	33 - 38 (*)	-
2-1	Rear Axle - Early Type	39 - 50 (**)	
2-2	Rear Axle - Late Type	51 - 62 (†)	5 - 7
3-B	Body	63 - 86 (†)	8
4-B	Air Brakes	87 - 104 (†)	9
4-C	Air Compressor and Governor	105 - 116 (†)	10
4-D	Hand Brake	117 - 118 (*)	-
5	Clutch	119 - 128 (*)	-
6-A	Cooling System	129 - 134 (*)	-
6-B	Radiator and Shutter	135 - 138 (*)	-
6-C	Fan and Water Pump	139 - 140 (†)	10 - 16
7-A	Wiring and Miscellaneous Electrical	141 - 154 (†)	17
7B	Battery	155 - 156 (*)	-
7-C	Starting System	157 - 166 (*)	-
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7-F	Regulator	175 - 184 (†)	23 - 28
7-G	Lighting System	185 - 190 (*)	-
8-A	Engine Tune-up	191 - 192 (*)	-
8-B	Diesel Engine	193 - 198 (*)	-
8-C	Engine Mounting	199 - 200 (*)	-
12-A	Fuel System	201 - 208 (†)	28
13	Lubrication	209 - 214 (†)	29
15	Spring Suspension	215 - 222 (†)	29
16	Steering Gear	223 - 234 (*)	-
17	Transmission	235 - 254 (†)	29
18	Propeller Shaft	255 - 258 (*)	-
19-A	Hubs and Bearings	259 - 262 (†)	29
19-B	Wheels and Tires	263 - 264 (*)	-
21	Trouble Shooting	265 - 271 (*)	-

* - No change. Refer to Maintenance Manual X-4711.
† - Changes covered in this supplement on pages shown.
** - Used on early model PD-3751 vehicles only.

SECTION 1-A
FRONT END ALIGNMENT

Pages 29 - 33: Service information contained in this section applies to all PD-3751 and PD-4151 vehicles with the following exception;

Toe-in value, as listed under "Wheel Alignment Dimensions," page 32 of maintenance manual (Form X-4711), should be changed to 1/16" - 1/8".

SECTION 2-2

REAR AXLE

Pages 51 - 62: Information contained in this section is applicable to PD-3751 and PD-4151 model coaches with the following exceptions.

Pages 58, 59, and 61: All service procedures listed under "Reassembly" should be replaced by the following:

AXLE ASSEMBLY

After all parts have been thoroughly cleaned, apply a thin coating of differential lubricant, as specified in Lubrication (Sec. 13 of X-4711), on all thrust or bearing surfaces. Coating parts will prevent scoring when vehicle is first placed in service.

Use of new lock washers, gaskets, and oil seals is recommended during assembly of axle. Check condition of threads on all bolts, screws, and studs before installation. Discard if damaged in any way.

All adjustments, given in assembly procedures, must be made carefully to insure efficient and continuous axle operation.

DRIVE PINION AND CAGE ASSEMBLY
(Fig. 1 - Page 52)

1. If pinion bearing cups (30 and 27) were removed during disassembly, press bearing cups firmly against pinion bearing cage (29) shoulders.

2. Position pinion bearing (26) on drive pinion (25), with widest part of bearing cone toward gear teeth, then press bearing on pinion until bearing cone seats solidly against drive pinion teeth.

3. Position drive pinion inner bearing (22) on drive pinion (25), place bearing retainer (23) on bearing, then install bearing retainer screw (24). Tighten screw until pinion bearing inner race seats solidly on drive pinion shoulder.

4. Install pinion bearing spacers (28) on drive pinion, then lubricate pinion bearing cones and cups with light engine oil.

5. Insert drive pinion and bearing assembly (25) into pinion cage (29); then, using an arbor press, press outer pinion bearing (31) firmly against bearing spacers (28). Rotate bearing cage through several complete revolutions to assure normal bearing contact.

6. While assembly is still in press under pressure, check drive pinion bearing pre-load. Wrap soft wire around pinion bearing cage (29) as shown in figure 1. Attach pound scale to wire, then pull on scale, keeping scale in a horizontal plane. Note scale reading when assembly is rotating freely. Reading should be from 12 to 18 inch pounds. To compute inch-pound value of scale reading, multiply scale reading (pounds) by one-half pinion cage diameter (inches). If reading does not fall between limits given, use thinner spacers to increase or thicker spacers to decrease pinion bearing pre-load. Spacer thicknesses available are given in "Specifications" on page 7 of this supplement.

NOTE: If arbor press is not available, temporarily install propeller shaft yoke (33), washer (35), and nut (34). Tighten nut to 700-900 foot pounds torque, then check pinion bearing pre-load as directed in preceding paragraph. Remove nut, washer, and yoke after adjustment.

7. After bearing pre-load adjustment is completed, lubricate oil seal assembly (32) and cover outer edge of seal body with a non-hardening sealing compound; then install seal in pinion cage (29), using a suitable driver.

8. Clean drive pinion splines (25) and propeller shaft yoke (33) splines, then install yoke on drive pinion. Place washer (35) on drive pinion (25), then install nut (34). Tighten nut to minimum torque (700-900 foot pounds), then tighten nut until next castellation on nut lines up with cotter pin hole in drive pinion and install cotter pin.

DRIVE PINION INSTALLATION (Fig. 1 - page 52)

1. Lubricate inner end of drive pinion with differential lubricant, recommended in Lubrication (Sec. 13 of X-4711).

2. Place pinion cage shims (39) over pinion cage studs (36), then position drive pinion and cage assembly on studs. IMPORTANT: Oil holes

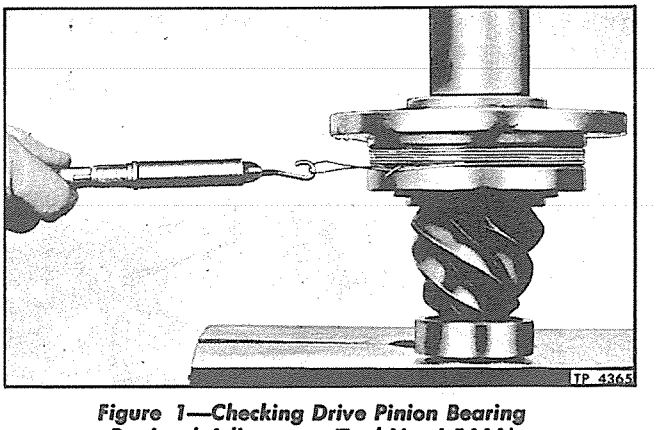


Figure 1—Checking Drive Pinion Bearing Pre-Load Adjustment (Tool No. J-544A)

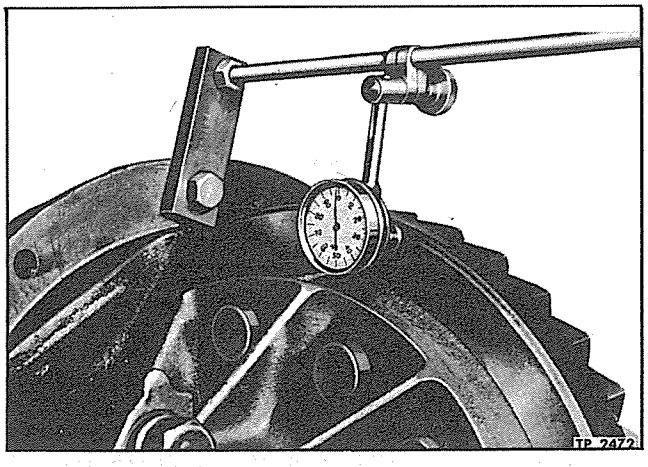


Figure 2—Bevel Gear Run-Out Measurement

in shims (39) and cage assembly (29) must line up with oil passages in differential carrier assembly (40), when installed, to assure proper lubrication of drive pinion bearings (26 and 31).

3. Install new lock washers (38) and nuts (37) on studs (36). Tighten nuts (37) to 85-95 foot-pounds torque.

DIFFERENTIAL CASE ASSEMBLY
(Fig. 1 - page 52)

After checking differential case runout as described under "Cleaning, Inspection, and Repair" on page 56 in X-4711, assemble differential case as follows:

1. Lubricate differential case inner walls and all component parts of differential assembly with lubricant specified in Lubrication (Sec. 13 of X-4711).

2. Position side gear thrust washer (16) on hub of side gear (17), then place gear in right-hand (flanged) section of differential case (18).

3. Lay right-hand section of case on bench with flange upward, place differential pinions (4) and pinion thrust washers (6) on differential spider (7), place pinion and spider assembly on side gear (17), then install remaining side gear (17) and thrust washer (16).

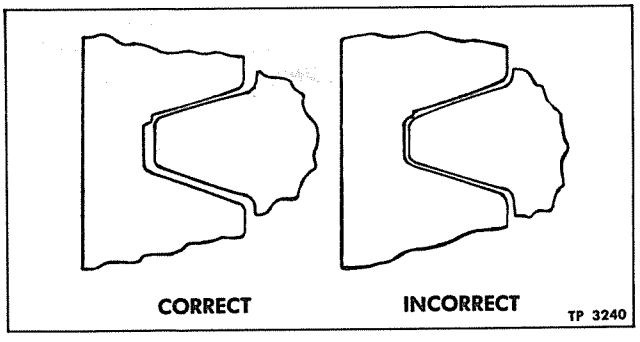


Figure 3—Worn Tooth Cross Section

4. Place left-hand section of differential case on right-hand section with alignment marks positioned as shown in figure 2, page 55, then insert case bolts (9) downward through left-hand section.

5. Install nuts (5) on bolts (9), tighten to minimum torque (155-200 foot-pounds). Tighten each nut until next castellation on nut lines up with hole in bolt, then install lock wire through all bolts.

6. Position drive gear (8) on differential case (18) flange, then install attaching bolts (41). Tighten bolts securely, then install lock wire (42) through bolt heads in such a manner that lock wire will become tighter as bolts loosen.

7. Press differential side bearings (12) on differential case (40) hubs until bearing cones seat firmly against case hubs.

DIFFERENTIAL AND DRIVE GEAR INSTALLATION (Fig. 1 - page 52)

1. Coat differential side bearing cones (12) and cups (11) with lubricant specified in Lubrication (Sec. 13 of X-4711).

2. Place bearing cups (11) over bearing cones (12), then position differential and gear assembly in differential carrier (40).

3. Insert bearing adjusting rings (13) and turn hand tight against bearing cups (12).

4. Place differential bearing caps (10) over studs with alignment marks in line, then tap lightly into position.

CAUTION: If bearing caps do not seat easily and properly, adjusting rings may be cross-threaded. Remove bearing caps and reposition adjusting rings. Forcing caps into position will result in irreparable damage to differential carrier or to bearing caps.

5. Install washers and nuts on bearing cap studs, tighten nuts snugly, then back nuts off until bearing adjusting rings (10) can be turned.

6. Tighten adjusting rings (10), alternately, until bearings (12) are seated in bearing cups (11). Revolve differential assembly after each tightening to keep bearing cups straight in bores.

7. After side bearings (12) are firmly seated, tighten left-hand adjusting ring one or two notches, then check drive gear run-out in manner shown in figure 2. Run-out should be within limits given in "Specifications" on page 62 in X-4711.

GEAR TOOTH CONTACT ADJUSTMENT

Drive pinion (25) is adjusted for tooth contact by means of shims (39) between pinion cage (29) and differential carrier (40). Drive gear (8) is adjusted by means of adjusting rings (10).

If original gears are reinstalled in assembly, painting gear teeth will not indicate the same contact as new gears and can be misleading. Gears that have been in service for extensive periods,

form running contacts due to wear on teeth. Therefore, the original shim pack (39) plus one .005" shim should be maintained to check backlash. Figure 6 - page 59, shows typical method of checking backlash.

In the event that backlash exceeds maximum tolerances, reduce backlash only in the amount that will avoid overlap of worn teeth as shown in figure 3. Smoothness or roughness can be noted by rotating drive gear. If a slight overlap, as illustrated in figure 3 exists, rotation will be rough. Generally, when original gears are reinstalled, tone should be satisfactory. When new gears are to be installed, differential bearings and drive pinion bearings must be in proper adjustment before any attempt is made to adjust backlash. Check backlash with dial indicator as shown in figure 6 - page 59, and adjust to obtain 0.006 - 0.012" lash as follows:

1. Paint at least ten teeth of bevel gear with a mixture of red lead or prussian blue and engine oil. Rotate gears through a few revolutions in both directions by hand. Refer to gear tooth contact charts, figure 7 - page 60, for directions for making proper adjustments.

2. When satisfactory tooth contact and backlash has been obtained, tighten bearing cap bolts securely. Install adjusting ring locks (3) and secure bolts (2) with lock wire.

DIFFERENTIAL BEARING PRELOAD ADJUSTMENT (Fig. 1 - page 52)

1. Using dial indicator at back face of drive gear (8) as shown in figure 4, loosen bearing adjusting ring (41) on side opposite bearing enough to notice end play on dial indicator.

2. Tighten the same adjusting ring until .000" end play is obtained.

3. Check drive gear for runout. If runout exceeds amount given in "Specifications" on page 62 in X-4711, remove differential assembly and check cause.

4. Tighten adjusting rings (10) one notch each from .000 end play position to impose correct pre-load on differential side bearings (12).

5. Tighten bearing cap stud nuts to 155-200 foot pounds torque, then install lock wires.

6. Install adjusting ring locks (3) and lock bolts (2), tighten bolts to 15-20 foot pounds torque, then install lock wires.

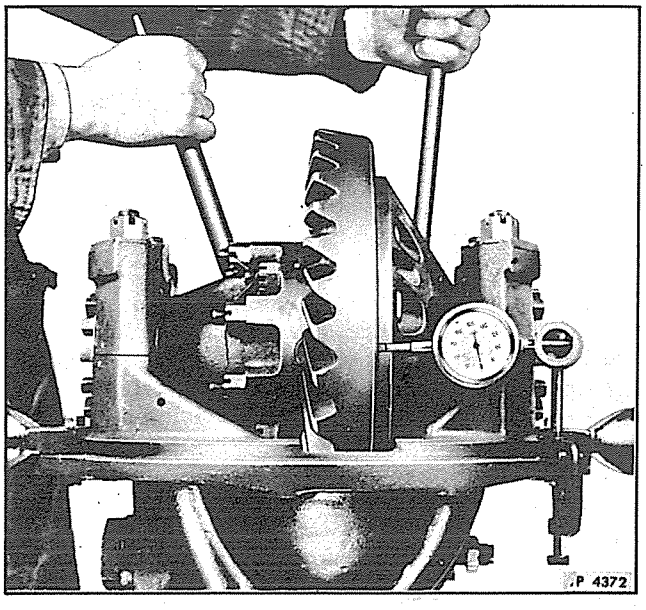


Figure 4—Differential Bearing Pre-Load Adjustment

DIFFERENTIAL CARRIER INSTALLATION (Fig. 1 - page 52)

1. Clean flanges of differential carrier (40) and axle housing (14), then position new differential carrier gasket (43) on carrier studs (21).

2. Roll differential carrier into position on roller jack. Start carrier into housing with four flat washers (19) and nuts (20) equally spaced, then tighten nuts alternately to draw carrier squarely into housing. CAUTION: Driving carrier into axle housing by use of a steel hammer will not only damage carrier stud flange but will also cause oil leaks.

3. Remove nuts and flat washers, then install lock washers and stud nuts. Tighten nuts to 65-75 foot pounds torque.

4. Connect propeller shaft to propeller shaft yoke (33) as instructed in Propeller Shaft (Sec. 18 of X-4711).

5. Install drain plug and tighten firmly. Fill axle housing to proper level with lubricant specified in Lubrication (Sec. 13 of X-4711). Replace and tighten filler plug.

SPECIFICATIONS

Specifications as given on page 62 in X-4711 apply with the following exception:

Drive pinion spacers are now serviced in the following thicknesses: 0.187", 0.188", 0.190", 0.192", 0.194", 0.196", 0.198", 0.200", 0.201", 0.215", and 0.229".

SECTION 3-B

BODY

Pages 63 - 86: Information contained in this section applies to Models PD-3751 and 4151 with exceptions noted below:

SIDE WINDOW SASH

(Page 73)

Late model PD-3751 and PD-4151 coaches are equipped with four single-glazed, sliding-type sash on each side. Sliding sash are mounted in Nos. 3, 5, 7, and 9 windows, remaining sash being double-glazed type described in manual.

Sliding-type (fig. 5) incorporate emergency escape feature, and may be cleaned as described in manual.

Ventilation

Sliding-type windows can be opened for ventilation by sliding forward half of glass to rear.

Glass Removal

1. Engage hook in eye at outer top of sash. Open window by pulling outward sharply on hook.
2. With window open, pry small spring-loaded plunger from rear hinge pin with screwdriver. Hold plunger out while sliding sash forward.
3. With hinge pins disengaged, remove sash from coach.
4. Remove one screw at front and four screws at rear which attach inner frame to outer frame. Remove inner frame from outer frame.
5. Remove two screws which attach vertical end rail to frame; then remove end rail.
6. Remove broken glass and glazing rubber; then clean frame channels thoroughly.
7. Position new rubber on glass; then install glass with rubber in frame.
8. Install vertical end rail and attaching screws.
9. Position inner frame in outer frame and install five attaching screws.
10. Position sash to body; then slide sash to rear to engage hinge pins.
11. Swing window upward into closed position. Make sure emergency escape latches have correct tension; adjust, if necessary.

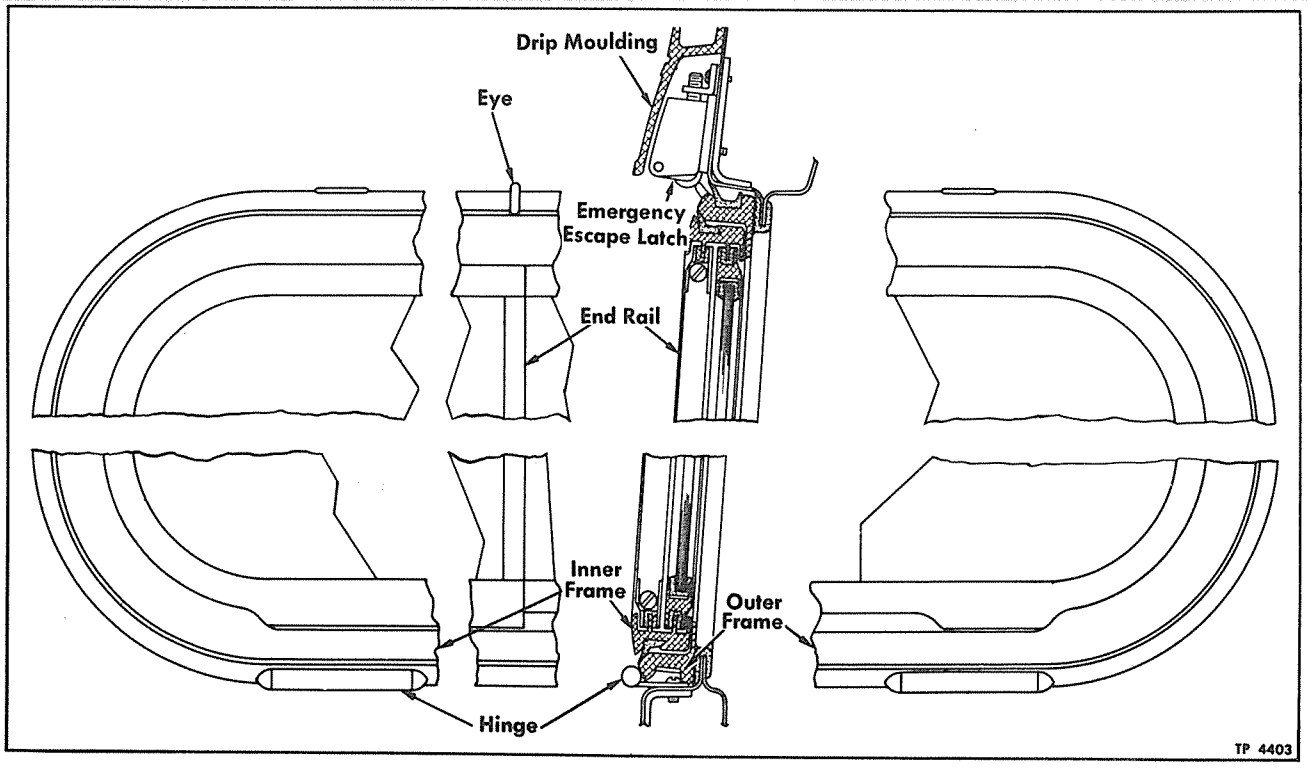


Figure 5—Sliding Type Slide Window Sash

SECTION 4-B
AIR BRAKES

Pages 87 - 104: Information contained in this section applies to all PD-3751 and PD-4151 vehicles with exceptions as follows:

Page 88 - BRAKE ADJUSTMENT

Type 25-2 slack adjusters are used at rear brakes on late model PD-3751 and all PD-4151 vehicles.

This slack adjuster incorporates a lock sleeve on the worm shaft to assure a positive lock of the brake adjustment (fig. 6). When adjusting rear brakes, lock sleeve must be pushed in before worm shaft can be turned. Make sure sleeve is pushed in far enough to clear hex end of worm shaft before turning shaft.

Page 93 - APPLICATION VALVE SERVICEABILITY TESTS

Brake application valves have been changed to deliver 75 pounds air pressure at the brake chambers instead of 65 pounds. Under "Operating Tests," the figure "65" should be changed to "75."

Page 97 - SLACK ADJUSTERS

Type RB slack adjuster covered in X-4711 is used only at front brakes on PD-4151. Slack adjuster used at rear brakes is type 25-2, typically illustrated in figure 6. Slack adjuster used has a curved lever arm (body) instead of straight lever arm shown. Slack adjuster "Serviceability Test" and "Replacement" as given on page 97 apply to type 25-2. The following procedure covers disassembly, inspection, and assembly.

SLACK ADJUSTER DISASSEMBLY (Fig. 6)

1. Remove dirt and grease from outside of unit by washing in a suitable cleaning fluid.
2. Cut off riveted ends of rivets attaching cover plates to body. Drive out rivets and remove cover plates.
3. Remove welch plug from end of worm shaft bore. Insert a flat end punch into the worm shaft bore and drive out worm shaft.
4. Remove lock sleeve and spring from worm shaft. Remove gear and worm from slack adjuster body. Remove grease plug.

INSPECTION AND REPAIR

1. Wash all parts in cleaning fluid and wipe dry.
2. Inspect worm and gear and replace with new parts if chipped or broken teeth are evident.
3. Inspect worm shaft for wear. Make sure corners on hex end are not rounded.

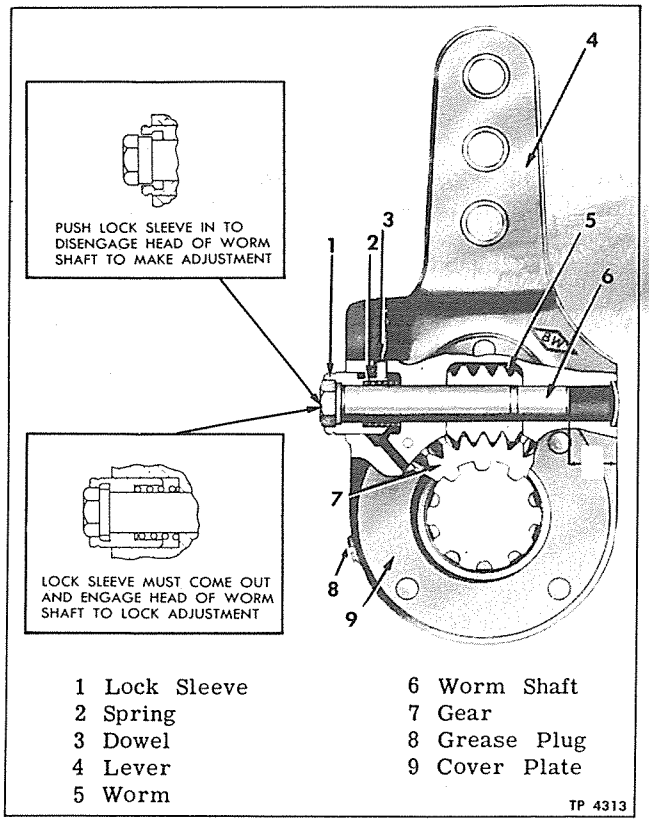


Figure 6—Type 25 Slack Adjuster

4. Inspect bushing in lever arm. If worn out-of-round or otherwise damaged, it must be replaced. To replace bushing, press old bushing out and press new bushing into place. Bushing must be reamed after installation to .501"-.503".
5. Examine lock sleeve for cracks or other damage. Replace if necessary.
6. Examine lever (body) for cracks or distortion. If lever is damaged in any way, a new body and bushing assembly must be used.

SLACK ADJUSTER ASSEMBLY (Fig. 6)

1. Place worm and gear in position in body.
2. Place lock sleeve over worm shaft, with socket-like end of sleeve at hex end of shaft. Place lock spring in recess formed by sleeve and shaft.
3. Enter small end of worm shaft through hole in body and worm. Press worm shaft into

worm and body, making sure the groove in lock sleeve is aligned with pin in body. Press shaft in until small end of shaft is 9/16" from edge of body, as shown in figure 6. Install new welch plug in worm shaft bore.

4. Position cover plates on body and attach with new rivets. Covers must be flat and in good contact with body after riveting.

5. Connect a grease gun to grease plug opening and force grease into slack adjuster until it is completely filled. Install grease plug.

REAR BRAKE SHOES, LININGS, AND CAMSHAFTS - Pages 99 - 102

Illustrations and procedures identified as "Late Vehicles" apply to PD-4151 vehicles.

SPECIFICATIONS
(Page 103)

Specifications for rear brakes identified as "Late Vehicles" apply to model PD-4151 vehicles.

SECTION 4-C
AIR COMPRESSOR AND GOVERNOR

Pages 105 - 116: Air compressor, used on late model PD-3751 and all PD-4551 coaches, has replaceable insert type connecting rod bearings instead of babbitted rods and caps. When overhauling compressor, replace bearing inserts if worn, cracked, or flaked. Bearings are available .010, .020, and .030 inch undersize for reground crankshafts.

SECTION 6-C
FAN AND WATER PUMP

Pages 139 - 140: Current Maintenance Manual (Form X-4711) contains service information applicable to early PD-3751 vehicles only. Information in following pages applies to all PD-4151, and PD-3751 vehicles equipped with variable pitch fan and vehicles with conventional type fan built with modified fan drive illustrated in figure 7.

FAN MOUNTING AND DRIVE

Radiator cooling fan is supported at front end of engine by bracket bolted to crankshaft cover (fig. 7). Fan blade assembly is bolted to adapter which is held to pulley by studs and nuts.

Fan pulley is driven from crankshaft pulley by a matched pair of V-type belts. Belt tension is adjusted by moving the idler pulley. Radiator core should be removed to permit access to pulleys and fan blades when replacing these items. Refer to Radiator and Shutters (Sec. 6B in X-4711) for instructions covering radiator removal.

FAN PULLEY

Fan pulley is mounted on a double row ball bearing assembly supported on spindle. Bearing is retained on spindle by nut which is tightened against inner race. Adapter (fig. 7), which is bolted to fan pulley, contacts bearing outer race to prevent endwise movement of bearing.

A spring-loaded lip type oil seal is installed in pulley hub behind bearing to prevent loss of lubricant.

IDLER PULLEY (Fig. 7)

Fan idler pulley, mounted as shown in figure 7, revolves on double row ball bearing assembly, inner race of which is retained on shaft by nut and lock. Shaft is press fit in idler pulley bracket. Bearing outer race is held in pulley by retainer bolted to front of pulley. Oil seal pressed into pulley hub retains lubricant.

Idler pulley bracket is held on fan pulley bracket by clamp bolt and provides means of adjusting fan belt. Threaded shaft, turned by hand wheels, moves idler pulley bracket, the threads on shaft being engaged with tapped hole through clamp bolt head.

DRIVE PULLEY

Fan drive pulley is installed on engine crankshaft ahead of vibration damper (fig. 7). Pulley is retained by bolt which is secured by lock.

DRIVE PULLEY REMOVAL

1. Relieve fan belt tension and remove fan belts.

2. Bend lock away from bolt head; then remove bolt from end of crankshaft.

3. Puller screw holes are provided in drive pulley. Remove pulley; also puller spacer, if used.

DRIVE PULLEY INSTALLATION

Whenever replacing fan drive pulley or vibration damper, a check must be made to determine

whether or not pulley spacer is required. With damper and pulley in place on crankshaft and pulley retaining bolt tightened to specified torque reading (180-200 ft. lbs.); measure distance from engine front end plate to forward side of damper. If this dimension measures 4.361 inches or less, remove pulley and install shim (fig. 7) or shims as required, to align drive pulley with idler pulley. When above distance measures more than the 4.361 inches, no shim is required.

1. After required quantity of shims has been determined, install shims and replace pulley on crankshaft. Retain pulley with bolt and new lock. Tighten bolt to specified torque and bend lock against bolt head.

2. Install fan belts and adjust belt tension as directed under "Adjustment" on page 11.

FAN BELT

A pair of matched belts is used to drive fan assembly. Belts run over a grooved idler pulley which is moveable for adjusting fan belt tension. Belts should always be replaced in sets.

ADJUSTMENT

To adjust fan belt, loosen idler pulley bracket clamp bolt nut; then turn idler pulley adjusting screw handle (hand wheel) as necessary to adjust belt so that a light pressure on belt, midway between pulleys, will cause 1/2 to 3/4 inch deflection as shown in figure 1. Be sure to tighten clamp bolt nut after belt adjustment is completed.

FAN BLADE ASSEMBLY (Conventional)

REPLACEMENT

1. Remove bolts which attach fan blade assembly to adapter (fig. 7); then remove assembly.

2. If necessary to remove adapter, remove adapter to pulley stud nuts after which adapter may be lifted off pulley.

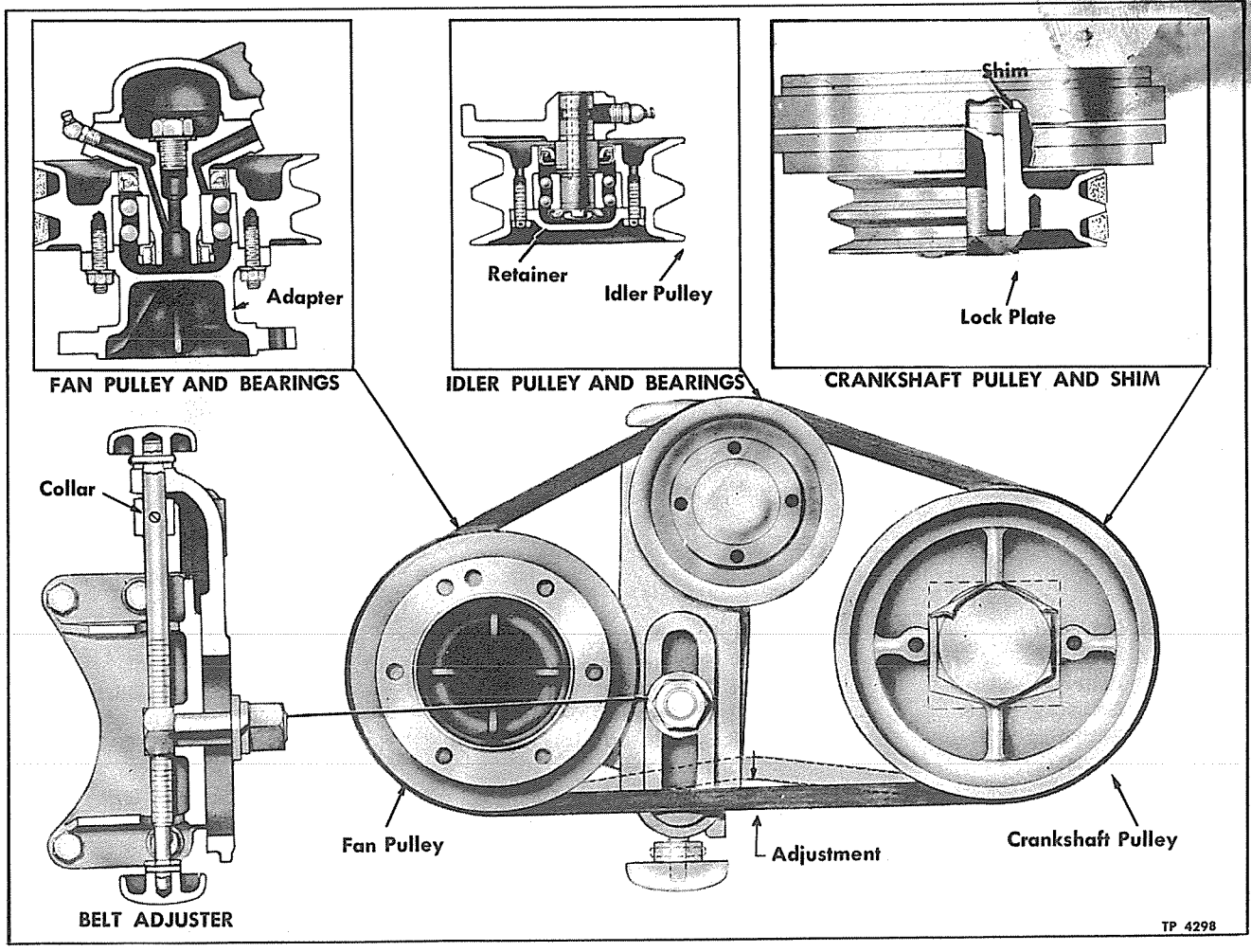


Figure 7—Fan Drive Showing Belt Adjustment
(Conventional Shown)

3. When assembling adapter to pulley, always use new gasket between these parts and use new lock washers on adapter to pulley stud nuts.

4. Set fan blade assembly on pilot at adapter with bolt holes through fan hub aligned with holes in adapter; then install attaching bolts, nuts and lockwashers.

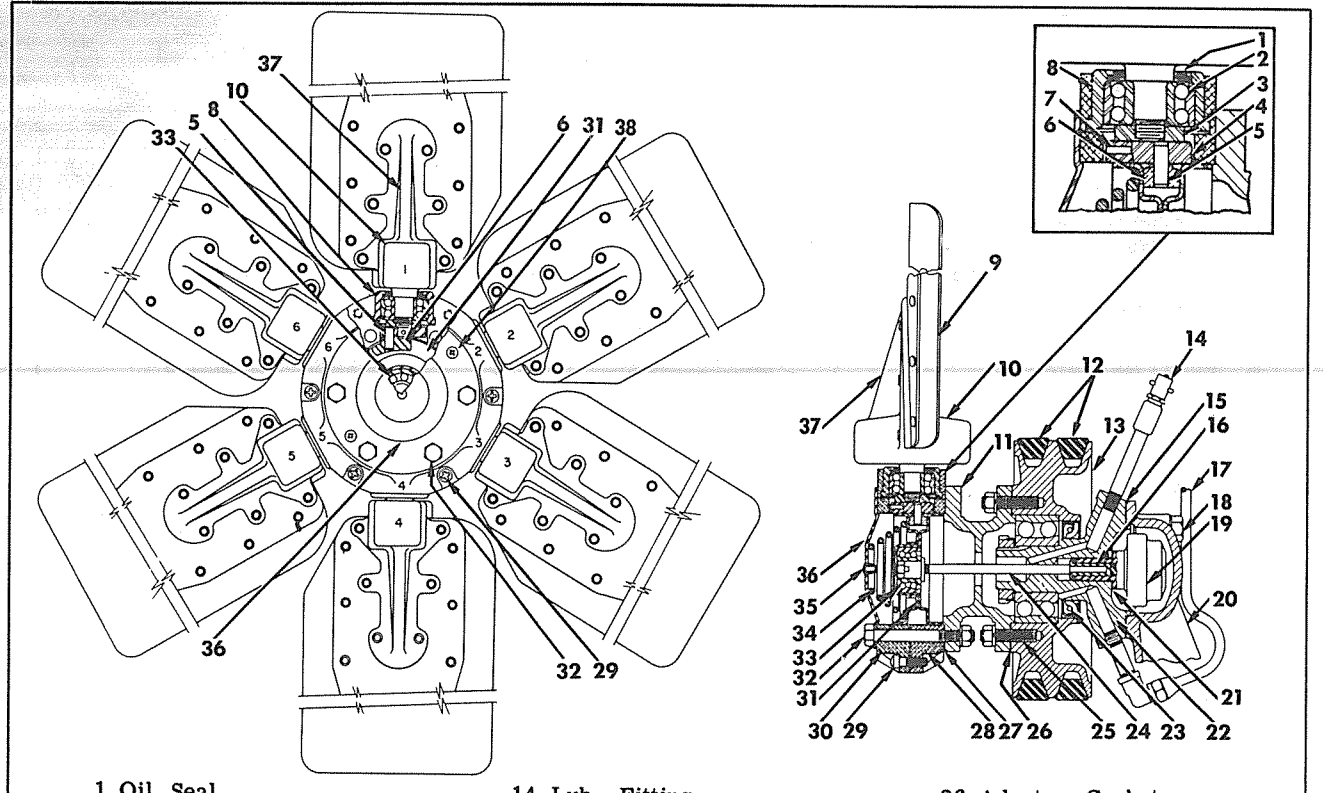
FAN BLADE ASSEMBLY (Variable Pitch Type)

Some vehicles are equipped with thermostatically controlled variable pitch fan assemblies. Radiator shutters are not used on vehicles so equipped. Key numbers in text refer to figure 8.

CONSTRUCTION (Figs. 8 & 9)

Variable pitch fan assembly consists of a two piece housing in which are assembled six fan blades mounted on double row ball bearing assemblies (2). A bell crank and moveable sleeve arrangement at inner end of fan blade arms provides mechanism for varying fan blade pitch.

Actuating mechanism, consisting of sleeve (31) which engages actuating shoe (6) on each blade assembly and return spring (34), is assembled in housing. Power which operates actuating mechanism is provided by thermostat (19) installed at fan pulley spindle (22). Adjustable push rod (24) transmits movement from thermostat to thrust bearing assembly (33) at center of sleeve (31). Thermostat is enclosed in chamber to which water lines from engine cooling system are connected. Water supply line, which is tapped into water manifold, feeds water at engine temperature into thermostat chamber. Water return line is installed between thermostat chamber and engine oil cooler.



1 Oil Seal
2 Arm Bearing
3 Bearing Nut
4 Actuating Plate
5 Actuating Pin
6 Actuating Shoe
7 Plate Retaining Pin
8 Bearing Retainer
9 Fan Blade
10 Fan Blade Arm
11 Fan Adapter
12 Fan Belts
13 Fan Pulley
14 Lub. Fitting
15 Spindle Gasket
16 Thermostat Piston
17 Lubricant Overflow Pipe
18 Spindle to Bracket Bolt
19 Thermostat
20 Fan Bracket
21 Thermostat Gasket
22 Spindle
23 Bearing Oil Seal
24 Push Rod
25 Adapter Stud
26 Adapter Gasket
27 Fan Gasket
28 Housing Rear Half
29 Housing Screw
30 Housing Front Half
31 Sleeve
32 Fan Mounting Bolt
33 Thrust Bearing
34 Spring
35 Relief Valve
36 Housing Cover
37 Fan Arm Web
38 Cover Screw

TP 4296

Figure 8—Sectional Views at Fan Hub and Pulley

OPERATION

When engine is cold, the fan blades should have a slight reverse pitch. Consequently no cold air is drawn through radiator core when cold engine is first started. When engine reaches operating temperature and thermostat in water manifold at engine opens, the heated water from cooling system begins to flow through thermostat chamber at spindle as well as through radiator core. When fan thermostat is heated to a temperature of 168°F. the push rod is forced toward fan blade housing and exerts force against thrust bearing (33) in sleeve (31, fig. 8). This movement rotates fan blade arms which are interconnected with groove around sleeve (31). As engine water temperature rises, fan blade pitch will be increased proportionately until the fan operating thermostat temperature reaches 192°F.

When water temperature falls below 192°F. the fan thermostat element contracts and spring (34) forces sleeve (31) toward thermostat thereby causing a reduction in amount of blade pitch.

MAINTENANCE

PUSH ROD ADJUSTMENT (Fig. 10)

Provision is made for adjusting length of push rod at fan hub assembly. Check adjustment whenever any of the parts of control mechanism are replaced. To accomplish this adjustment operation, the tool shown in figure 10 must be used. Water in engine cooling system must be below 130°F. before adjustment can be made. Adjust as follows:

1. Remove fan blade assembly from adapter on fan pulley.
2. Loosen push rod lock nut.
3. Bolt adjusting tool in position as shown, using fan mounting gasket between tool and adapter.
4. Turn push rod adjusting nut until it is locked securely against bottom face of tool at .640 to .636 inch dimension. Replace lock nut and tighten securely without changing position of push rod adjusting nut.
5. Remove adjusting tool and install fan assembly, using same gasket as was used when making adjustment.

THERMOSTAT REPLACEMENT (Fig. 8)

Whenever it is necessary to replace thermostat at fan pulley spindle, the operation can be accomplished as follows:

1. Drain engine cooling system.
2. Remove radiator assembly from vehicle.
3. Remove fan drive belts.
4. Remove fan assembly from adapter by removing mounting bolts and lifting fan assembly off adapter. CAUTION: In removing fan, be careful to move assembly straight away from adapter to avoid damaging push rod.

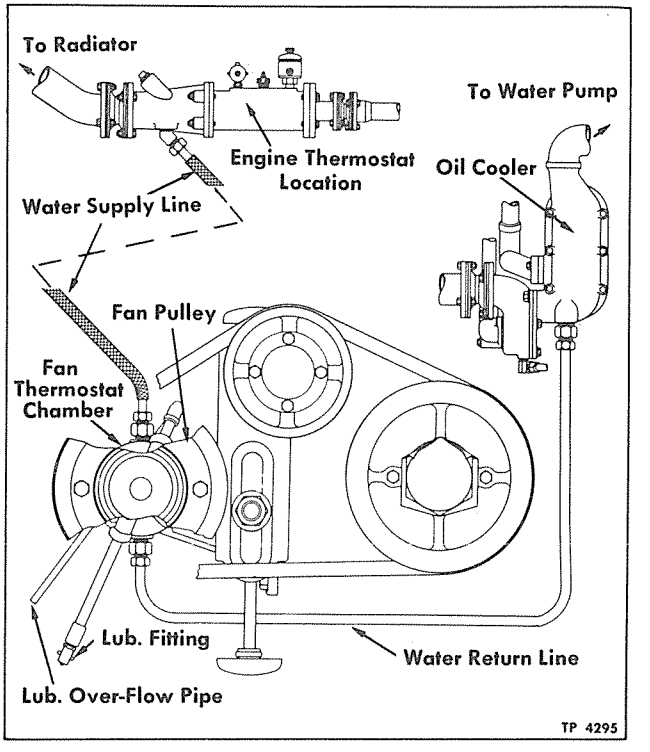


Figure 9—Water Line Layout

5. Remove bracket to spindle bolts (18), then remove spindle, pulley, adapter, and thermostat as an assembly.

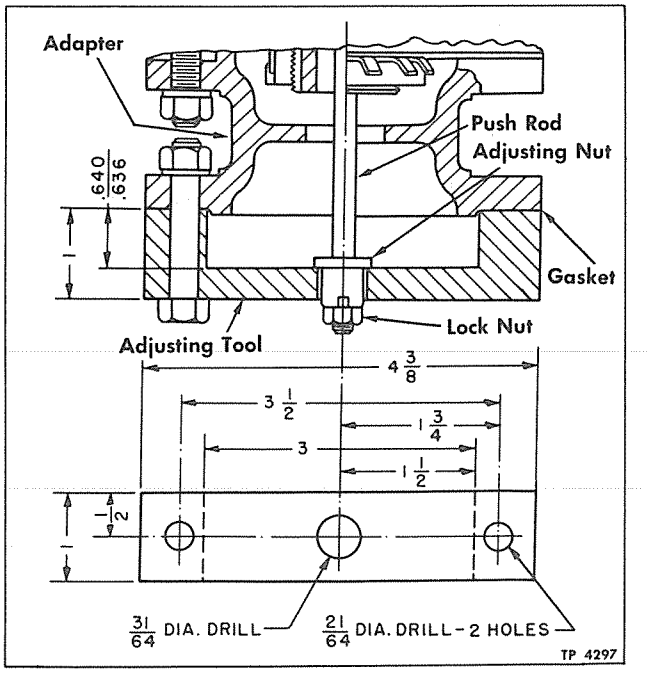


Figure 10—Push Rod Tool and Application

6. Using special wrench unscrew thermostat from spindle. CAUTION: Damage to thermostat will result unless proper wrench is used.

7. Coat both sides of thermostat gasket (21) with sealing cement, which is impervious to anti-freeze solution (if used). Assemble thermostat with gasket at spindle and tighten thermostat firmly using special wrench mentioned above.

8. Using new spindle to bracket gasket, mount spindle and pulley assembly on bracket and tighten bolts firmly.

9. Place push rod through hole in adapter and into place in thermostat piston (16); then use gauge tool as previously instructed under "Adjustments" to properly adjust push rod.

10. Mount fan assembly on adapter using new gasket, then lubricate fan assembly following recommendations given in Lubrication (Sec. 13 of X-4711).

11. Install fan belts and adjust belt tension as previously directed in "Adjustments."

12. Install radiator, connect water lines and fill cooling system.

LUBRICATION

Fan pulley bearing and moving parts at fan hub are lubricated through fitting installed in fan bracket spindle (fig. 9). A lubricant overflow tube is also installed in spindle and relief valve is incorporated in front cover, to prevent pressure build-up within hub assembly. Refer to Lubrication (Sec. 13 of X-4711) for lubrication periods and lubricant specifications. Fan blades should be slowly oscillated manually while applying lubricant to assure complete filling of cavity inside hub. CAUTION: When lubricating fan assembly, if the lubricant overflow appears milky, moisture is indicated and measures should be taken to correct the condition. When the above condition occurs, it will usually be due to water leak at thermostat gasket (21, fig. 8). Removing thermostat and applying gasket cement on both sides of thermostat gasket will eliminate any water leakage. Refer to "Thermostat Replacement" earlier in this section for detailed instructions covering thermostat replacement.

SETTING BLADES FOR STATIONARY PITCH (Emergency Only)

In case of failure of automatic control mechanism, provision is made whereby the fan blade pitch can be set and locked in full pitch position.

Should the automatic pitch control become inoperative to the extent of causing overheated engine; proceed as follows to temporarily set blades in full pitch:

1. Loosen lock nut on screws (R.H. View, fig. 12) then turn blades to full pitch position.

2. While holding blades in full pitch position, tighten screws into drill point holes at fan hub. Secure screws with lock nuts.

CAUTION: Vehicle should be operated with blades in fixed position only until automatic control can be repaired.

READJUSTMENT OF THERMOSTAT

Since no load is exerted against thermostat when fan is locked in fixed pitch position, the unit when once expanded by heat, will remain in expanded condition until reset as described below. Before returning to automatic operation it will be necessary to remove thermostat and reset the thermal unit before push rod can be adjusted. CAUTION: Do not attempt to reset thermostat without proper equipment. If equipment is not available replace thermostat with new unit. To return thermostat piston to normal "Cold" position proceed as follows:

1. Place thermostat in fixture in which thermostat can be submerged in water while applying approximately a 100 lb. load against piston. Fixture must be equipped with thermometer and means of heating water.

2. Raise water temperature until piston in thermostat begins to move outward. This should take place before water temperature reaches 192°F.

3. Allow thermostat to cool to room temperature; then using feeler gauge, measure space between piston flange and thermostat body. Discard thermostat if space is less than .025 inch or more than .075 inch. If space is within above dimensions, reinstall thermostat and adjust push rod.

FAN DISASSEMBLY

(Fig. 8)

1. Remove fan assembly from adapter (11) at fan pulley (13), being careful to pull fan straight away from adapter to avoid damage to push rod.

2. Insert two mounting bolts through diametrically opposite holes in fan hub. Install 5/16 inch flat washer and nut on each bolt. Remove cover screws (38); then loosen nuts on bolts to relieve tension on spring (34). Remove bolts and cover (36) from housing and lift out spring (34).

3. Remove six cross-recess head screws (29) which hold halves of housing together. Then separate halves of housing. Be careful not to lose actuating shoes (6) which will be free to fall off pins (5) when housing is taken apart.

4. Bearing assemblies (2 and 33) may be inspected without removing from companion parts.

PARTS INSPECTION

1. Inspect each ball bearing assembly for roughness and wear to ascertain if bearings are fit for further use.

2. Check fit of actuating shoes (6) on pins

(5) and also check clearance between shoes (6) and groove in sleeve (31). Replace parts if clearances are in excess of those given in "Specifications" on page 16.

3. Examine lubricant relief valve (35) in front cover to see that valve is free.

4. Make careful inspection of housing castings (28 and 30) to determine if parts are distorted or fractured.

REPAIR

FAN BLADE BEARING AND OIL SEAL REPLACEMENT (Fig. 8)

If necessary to replace oil seal (1) or bearing assembly (2) one of which is used on each fan blade arm, proceed as follows:

1. Drive out pin (7) which retains plate (4) on arm (10) and remove plate.
2. Remove bearing nut (3) from arm (10).
3. Pull bearing retainer (8), bearing (2), and oil seal (1) as an assembly.
4. Support retainer (8) at flange and press out bearing assembly (2), after which oil seal (1) may be removed from retainer.
5. After thoroughly cleaning parts install new oil seal in retainer then press bearing assembly (2) into retainer (8) applying pressure at bearing outer race. Bearing must seat in counterbore in retainer and hold oil seal (1) in place.
6. Apply lubricant on oil seal lip and pack bearing with lubricant of type specified in Lubrication (Sec. 13 of X-4711).
7. Grip fan blade assembly in vise jaws at rib (web) on blade arm, then install bearing and retainer assembly on blade arm shank using bearing driver which will fit over shank and contact bearing at inner race. Install bearing nut (3) and tighten firmly.

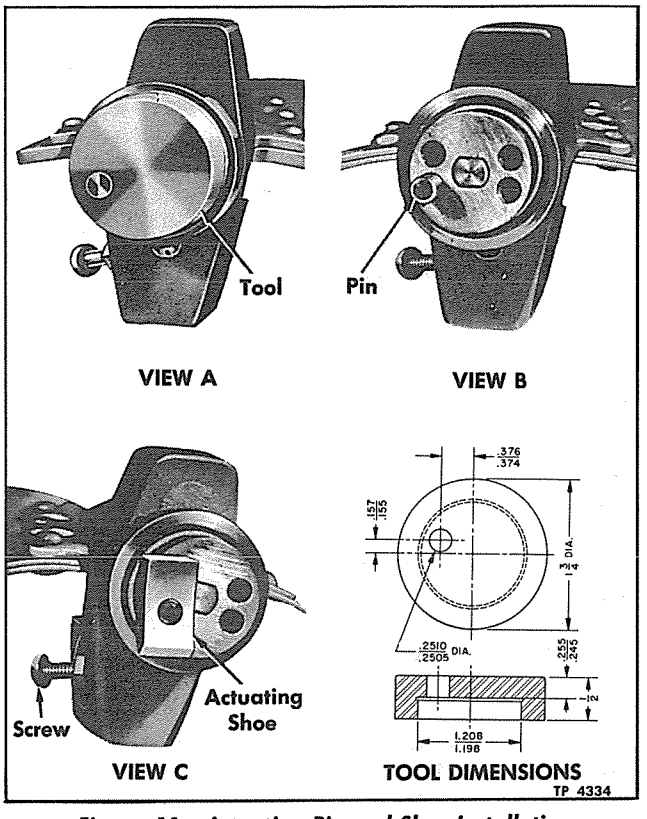


Figure 11—Actuating Pin and Shoe Installation

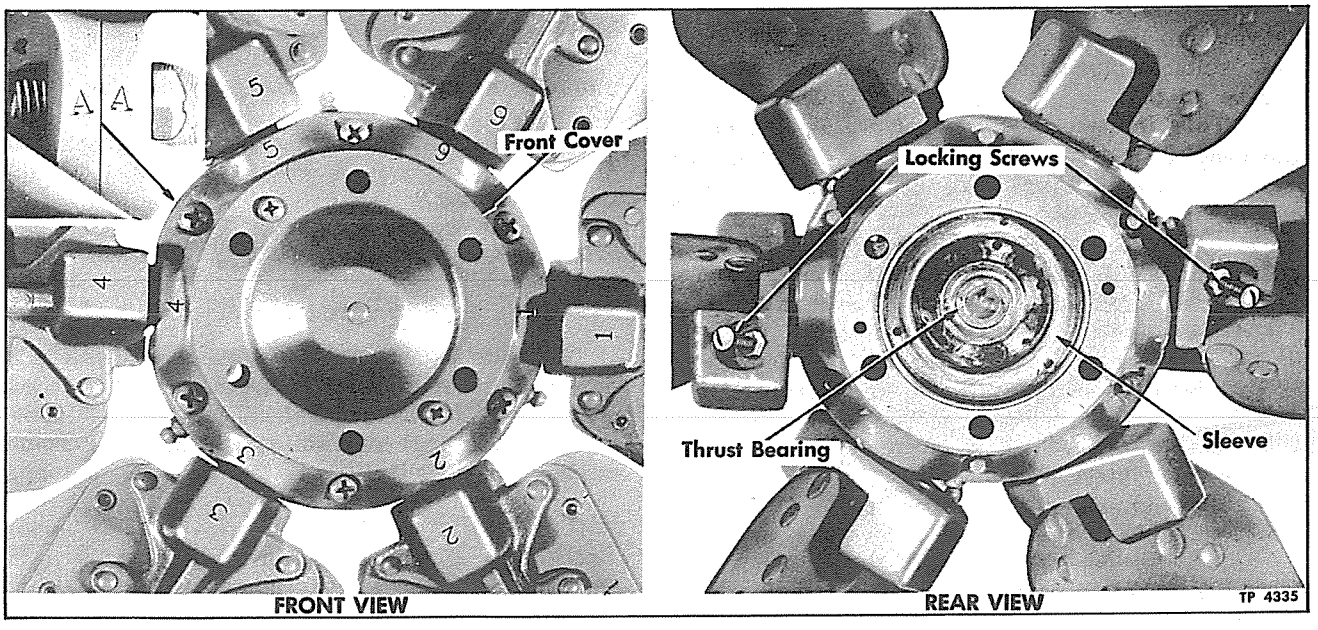


Figure 12—Front and Rear Views at Fan Hub

8. Install plate assembly (4) including pin (5) in position shown in View "B" figure 11. Drive in new pin (7) to retain plate (4) on arm (10).

THRUST BEARING REPLACEMENT (Fig. 8)

1. Support actuating sleeve (31) at surface immediately surrounding bearing bore, then press thrust bearing (33) out of sleeve. CAUTION: Do not support sleeve at outer edge while removing bearing as sleeve will be distorted.

2. Press out bearing by applying pressure on inner race.

3. Thrust bearing will take load in either direction. Press bearing into sleeve until outer race bottoms solidly in bearing pocket. CAUTION: Do not cock bearing while pressing it into sleeve.

ACTUATING PIN REPLACEMENT

1. To remove actuating pin (5) from plate (4) when plate is mounted on blade arm, grip pin tightly in vise jaws; then pull on blade with rotary motion to separate parts.

2. Using guiding tool (fig. 11) to hold new pin, drive pin into hole in plate as shown in figure 11. NOTE: Hold tool closely and firmly against bearing nut (3) to assure squareness. Press pin in flush with surface of tool.

REASSEMBLY

(Fig. 8)

1. Mark location of No. 1 blade on housing rear half (28). This location may be determined by holding two halves together with match marks indexed as in inset (fig. 12), and observing numerals stamped on front half (30).

2. Lay rear housing half on bench, then set sleeve and bearing assembly in place at bore, using suitable block to support sleeve so groove will be slightly above top face of housing rear half. This is necessary to permit assembly of actuating shoes (6) in sleeve groove. NOTE: Be sure to install sleeve with open side of thrust bearing toward rear.

3. Place actuating shoe (6) on pin (5) on No. 1 blade assembly, then with blade reinforcement upward,, lift blade into position so shoe will enter groove in sleeve (31) and so bearing retainer (8) is adjacent to mark made in step 1 above. Rotate blade counterclockwise to enter bearing retainer in bore in housing.

4. Repeat procedure as given in step 3 above to assemble each of the five remaining blade assemblies at housing, proceeding in clockwise direction from No. 1 blade.

5. Set housing front half (30) over bearing retainers with match marks (insert, fig. 12) aligned. Carefully push front half of housing down over bearing retainers and sleeve. CAUTION: DO NOT FORCE HOUSING INTO PLACE. IF FRONT HALF DOES NOT GO DOWN AGAINST REAR HALF FREELY, CHECK FOR MISALIGNMENT OF BEARING RETAINERS OR SLEEVE.

6. Install six housing assembly screws (29), tightening evenly and firmly.

7. Set spring (34) in place with large end seated at sleeve (31). Place cover (36) against spring; then draw cover down against housing by using two mounting bolts with flat washers and nuts. CAUTION: Draw nuts down evenly to avoid distorting cover. Also be sure cover screw holes are aligned with tapped holes in housing.

8. Install cover screws and tighten firmly.

9. Install push rod and check adjustment as previously instructed in "Push Rod Adjustment" in this section.

10. Mount fan assembly on adapter on fan pulley, using new gasket (27).

11. Apply lubricant through fitting at spindle meanwhile oscillating blades manually to assure filling housing completely. Note: When housing cavity is filled, lubricant should begin to bleed from overflow pipe (17) and relief valve (35).

WATER PUMP

Description and instructions for maintenance of water pump used in Diesel engine equipped vehicles are contained in separate maintenance manual for Diesel engine (Form X-4719).

SPECIFICATIONS

FAN (Conventional) . . . . . Refer to X-4711

FAN (Variable Pitch)

Make	Evans Products Co.
Drive	Belt from Crankshaft Pulley
Number of Blades	6
Diameter	26"
Rotation	Counterclockwise
Actuating Shoe to Sleeve Clearance (Max.)	0.012"
Thermostat Operating Temperature Range	168-192°F.

SPECIAL TOOLS

The following special tools are not supplied by the Coach manufacturer. Name and address of tool vendor are shown as a reference, and all information regarding availability, price, etc., should be obtained directly from them.

Tool No.	Tool Name	Vendor
CS-1508	Actuating Pin Tool	CS*
CS-1426	Push Rod Gauge	CS*
CS-1425	Thermostat Wrench	CS*

* Curtis-Smith - Pottstown Pa.

SECTION 7-A
WIRING AND MISC. ELECTRICAL

Page 141: When servicing late model PD-3751 and all PD-4151 vehicles, wiring diagram shown in this supplement should be used instead of diagram in current Maintenance Manual (Form X-4711). This latest diagram shows all the wiring changes and electrical units that have been added since first production vehicles.

The following major changes are shown on the accompanying diagram.

HEADLIGHT AND FOG LIGHT SELECTOR SWITCH

A selector switch is being added which selects either the headlight or the fog light circuit. When this switch is used it is impossible to use headlights and fog lights at same time. With the use of the selector switch, the "Fog" manual switch circuit is no longer necessary and therefore has been disconnected.

DEFROSTER SWITCHES

Defrosters are now equipped with individual switches which control the speed of the defrosters. Switches are three position type, namely; "Hi" - "Lo" - "Off." Defroster switches are not operative until "Defr" switch at switch panel is pulled out to energize the defroster circuit.

WINDSHIELD FANS

Two windshield fans and individual control switches have been added. Each fan is controlled by a three position switch which can be moved to "Hi" - "Lo" and "Off" positions. Fan circuit is fed from #30 fuse.

ENGINE STOP SOLENOID RELAY

A relay has been added in the engine stop solenoid circuit. The relay is mounted to a panel in the regulator compartment.

Adjustments required for this relay are - air gap, point opening and closing voltage. Method of accomplishing these adjustments is fully explained under "Starter Solenoid Relay" on pages 164 and 165 in Form X-4711.

Page 145: Following information should be added to Maintenance Manual (Form X-4711) under "Engine Compartment Panel."

Term. No.	Circuit	Wire Size & Color
1	Taillights and Highway Sign	No. 16 Black-Green Tr.
2	Stop Lights	No. 16 Red
3	Rear Directional Light L.H.	No. 16 White - Black Cr. Tr.
4	Rear Directional Light R.H.	No. 16 White - Red Cr. Tr.
5	Reverse Relay	No. 14 Blue
6	Starter Control	No. 14 Red

SECTION 7-E
GENERATOR

Pages 167 - 174: Information contained in this section in current manual (Form X-4711) is applicable to early model PD-3751 vehicles only.

Following service procedures should be followed when servicing generators on late model PD-3751 vehicles and all PD-4151 vehicles.

CONSTRUCTION

Generator (fig. 13) is a heavy-duty, six brush, shunt type unit with special interpole windings in series between the insulated brushes and the armature terminal. Interpole windings improve commutation and make possible a higher output. Maximum output is possible at moderate armature speeds because of the high field current, which is approximately three times greater than in ordinary heavy duty generators.

Generator is mounted on flywheel housing and is driven through gears connecting generator and engine balance shaft. Armature shaft is supported at drive end by a straight roller bearing, and at commutator end by a single row ball bearing.

Air for Cooling and ventilating generator is drawn through unit by fan at commutator end.

INSPECTION AND MAINTENANCE

Normal service may be obtained from generator with a minimum of trouble if regular inspection and maintenance procedures are followed.

LUBRICATION

Bearing at drive end is lubricated through a grease cup. Bearing at commutator end requires lubrication only at time of overhaul. Refer to Lubrication section for type of lubricant and interval of application.

CLEANING

Exterior as well as the interior of the generator assembly should be kept clean. Use a clean cloth, dampened with cleaning solvent, to wipe off excess grease. Do not steam clean or

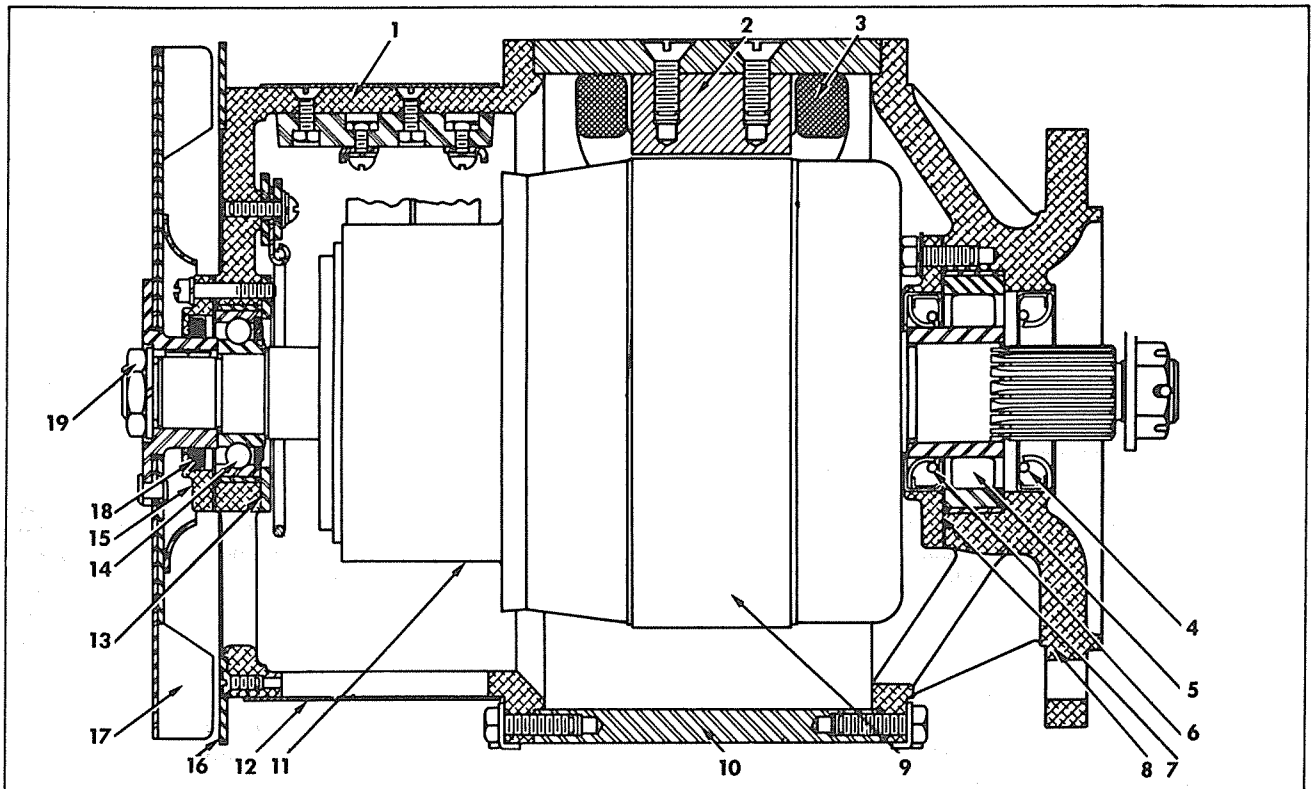


Figure 13—Sectional View of Generator

dip generator into a cleaning solvent. Avoid getting any water or cleaning solution in the generator. If interior of generator is dirty, remove, disassemble and clean all individual parts.

Clean only with solvents derived from petroleum such as kerosene or gasoline. Never use chemical solvents or alkalies since these may damage the insulation.

COMMUTATOR

The cover band should be removed and commutator inspected at 5,000 mile intervals. If commutator is dirty, clean with a strip of No. 00 sandpaper.

DO NOT USE EMERY CLOTH. All dust must be blown from generator after commutator has been cleaned.

BRUSHES

Check the surface of the brushes making contact with commutator to be sure they are seating. Replace worn brushes. Note: When new brushes are installed it will be necessary to adjust generator neutral point as directed under "Assembly" later in this section. Brushes may be seated by use of a brush seating hone. Do not use emery cloth or sandpaper. With generator operating at medium speed, press seating hone firmly against commutator to cover area contacted by brushes. Brushes should then seat satisfactorily in a short period. Blow generator out with compressed air to remove all abrasive particles after using hone. Check tightness of pigtail lead connections.

Brush Spring Tension

Check brush spring tension. Replace springs if tension is not as specified in "Specifications" on page 22.

Excessive spring tension will cause commutator and brushes to wear rapidly; while low spring tension will cause a reduced generator output, also arcing and burning of commutator and brushes.

MISCELLANEOUS

Make careful inspection of wires, terminals

and all visible parts of generator. Any apparent defects should be corrected immediately. A poor connection in charging circuit will cause generator to build up excessive voltage, which may result in burned field or armature windings. A poor connection in generator field circuit will cause a low output.

Noise in generator may be caused by loose mounting or worn drive parts. Worn or dirty bearings, which may cause noise, require cleaning and lubrication or, if worn excessively, replacement. Improperly seating brushes or bent brush holder may cause noise, requiring replacement.

GENERATOR DRIVE

Generator is attached directly to flywheel housing. An external tooth gear, mounted on generator armature shaft, meshes with an internal tooth gear attached to balance shaft gear. These gear teeth mesh only on one side, therefore generator is driven faster than engine balance shaft. This arrangement permits generator to be driven fast enough that charging rate is maintained at idling speeds.

REPLACEMENT

REMOVAL

1. Remove stud nuts and lock washers from three terminals on generator, then remove wires from each terminal. Tag each wire for identification at time of reinstallation.

2. Remove bolts, nuts, and lock washers attaching generator to flywheel housing. Carefully pull generator straight away from engine to complete removal.

INSTALLATION

1. Position generator to flywheel housing, making sure generator drive gear teeth mesh with balance shaft gear teeth. Install bolts, lock washers, and nuts. Tighten nuts evenly and alternately.

2. Install wires on three generator terminals according to identification used at time of removal or refer to Wiring Diagram. Install lock washers and nuts and tighten securely.

3. Before starting engine, polarize generator.

POLARITY

When generator or regulator wires have been disconnected, especially when new unit is being installed, generator must be polarized after units are installed -- BEFORE ENGINE IS STARTED. Failure to polarize generator will cause regulator points to vibrate excessively and burn. Remove wire from "Field" terminal at regulator. Momentarily touch wire removed from "Field" terminal to "Battery" terminal of regulator. This connection allows a momentary surge of battery current to reach generator field windings which automatically gives generator the correct polarity with respect to battery it is to charge. Reconnect wire to regulator "Field" terminal.

TESTING

Before generator is removed from engine, or with generator on bench, Operation Tests in Regulator section of this supplement should definitely establish which unit, generator, or regulator is at fault. When it has been definitely established that generator is at fault, localize trouble in generator as follows:

1. NO OUTPUT

Remove cover band and check for sticking brushes, or for other causes of poor contact between commutator and brushes. Correct sticking brushes by cleaning brush holders and brush arms. Correct dirty armature as explained under "Inspection" later in this section. If trouble is still not corrected, test further as below:

a. Test for grounded armature by raising and insulating the grounded brushes from the commutator and checking with test points from "A" terminal to frame. Light should not light. If test lamp lights, raise other brushes and check "A" terminal and commutator separately to locate geound. A ground in an interpole winding will cause "A" terminal to appear grounded since the interpole windings are in series with the "A" terminal and insulated brushes. When such a ground is indicated, the interpole coils must be checked individually to locate the trouble.

b. Test for open field circuit with test points between "F" terminal and "G" terminal. If test lamp fails to light, field is open circuited. Replace field if defective.

c. Test for shorted field circuit with battery and ammeter connected in series with field circuit. A shorted field will draw excessive current, so care must be taken to avoid damaging ammeter. Refer to "Specifications" on page 22 of this supplement for current draw. If field is grounded or shorted, it will be necessary to disassemble generator to locate trouble.

d. An open circuit in the armature is usually apparent, as this condition usually causes burned armature bars.

e. If trouble has not yet been located, remove the armature and check on a growler for short circuit in manner described under "Testing Parts" later in this section.

2. EXCESS OUTPUT

Generator will produce excessive output due to shorted generator fields that prevent generator

regulator from inserting resistance into field circuit. Refer to item "C" above under "No Output" for test method.

3. UNSTEADY OR LOW OUTPUT

Unsteady or low generator output may result from several conditions as follows:

a. Sticking brushes, low brush spring tension, dirty commutator or other conditions which prevent good contact between brushes and commutator. Correct as directed under "Inspection and Maintenance" previously in this section.

b. Rough, out-of-round, burned commutator, or if dirty between segment slots, or has high mica, may cause low or unsteady output.

DISASSEMBLY

1. Remove fan retaining nut from armature shaft, then remove fan and Woodruff key.
2. Remove cover band clamp screw then remove band.
3. Remove screws and lock washers attaching commutator end frame to field frame. If necessary, tap end frame with soft hammer to loosen, then remove end frame as an assembly.
4. Remove cap screws and lock washers attaching inner and outer bearing retainers to commutator end frame then remove bearing. Remove screws and lock washers attaching brush plate assembly to commutator end frame. Remove brush plate assembly.
5. Note position of grounded and insulated brushes also location of insulating washers so that they can be reassembled to their original position.
6. Remove cap screws and lock washers attaching drive frame to field frame. If necessary tap end frame with soft hammer to loosen, then remove end frame and armature.
7. Remove nut and washer on drive end of armature shaft. Press armature out of drive end frame and gear.
8. Remove bolts and lock washers attaching oil seal and bearing retainer to end frame. Remove retainer with seal and gasket. Remove bearing from drive end frame.
9. Field coils and pole shoes may be removed from the field frame by removing pole shoe screws and disconnecting field coil lead or removing stud. NOTE: Field coil test must be made before the field coils are removed from the generator.

INSPECTION

CLEANING

All parts except field coils and armature should be washed in cleaning solvent. Field coils and armature should be wiped clean with a dry rag.

ARMATURE

Check armature to commutator leads to be sure they are properly soldered. Loose leads should be resoldered as directed under "Repair" later in this section.

COMMUTATOR

Inspect commutator and if found to be rough, out-of-round, worn or has high mica, filled slots or is burned it must be replaced or repaired as directed under "Repair" later in this section.

FIELD COILS

Use care in handling the coil assembly to avoid breaking or weakening leads. The field insulation must be in good condition. If insulation is cracked, charred or worn so that wire is exposed, repair as directed under "Repair" later in this section or replace.

BRUSHES

Replace brushes if worn down to less than half their original length. Be sure that pigtail leads are secure in the brushes, and that clips are properly soldered to the leads.

Brush Springs

Brush springs must have sufficient tension to provide proper pressure between brushes and commutator after the generator is reassembled. Replace springs if damaged or if tension is not as shown in "Specifications" on page 22.

Brush Holders

Carefully examine brush arms, arm pins, and holders for bent, warped or damaged condition. Any condition that might interfere with proper brush action should be corrected.

BEARINGS

Carefully inspect bearings for evidence of damage, and wear. Replace if worn or damaged.

SEALS

Felt Type

Carefully inspect felt seal for damage or excessive wear. If seal is worn or damaged it must be replaced as directed under "Repair" later in this section.

Lip Type

Inspect seals for wear, deterioration or damage to the sealing surface. Replace as directed under "Repair" later in this section if any damage is evident.

MISCELLANEOUS

Carefully inspect insulators and insulating washers for damage or burned condition. Inspect all studs or screws for bent or damaged condition and cross threads.

TESTING PARTS

Generator parts may be tested with suitable electrical testing equipment. Instructions furnished by manufacturer of test instrument used, should be followed.

ARMATURE

Following armature tests should always be made while generator is disassembled.

Ground

With a conventional test light and prods, place one test prod on armature and other to commutator. If test lamp lights, armature is grounded and should be replaced.

Open Circuited

An open circuit in the armature usually results in badly burned commutator bars which can be easily detected visually.

Short Circuited

Place armature on growler connected to alternating current. Hold hack saw blade over armature while armature is rotated slowly. If saw blade vibrates or buzzes, armature is short circuited. Before replacing an armature that is apparently shorted, inspect the commutator slots for copper or brush dust deposits. Clean thoroughly and again test.

TERMINAL CIRCUIT TEST

Place one test prod on armature terminal and other on terminal of each wire. If test lamp does not light, wire is open circulted and should be replaced.

FIELD COILS

Following field coil tests should be made while coils are installed in place in housing.

Continuous Circuit

Remove grounded end of field coil from inside of field frame. Place test prods on field coil terminals. If test lamp does not light, field coils are open circuited and should be replaced.

Ground

Disconnect grounded end of field coil winding from housing. Place one test prod on generator housing and other on field terminal. If test lamp lights, field coils are grounded and should be replaced.

Current Draw Test

Remove grounded end of field coil from inside of field frame. Place test lead on ground terminal and other test lead on "F" terminal, with ammeter connected. Take ammeter reading. Remove test leads and securely reconnect ground lead to inside of field frame. Field coils should draw current as indicated in "Specifications" on page 22. Replace if they do not meet "Specifications."

BRUSH HOLDER TEST

Place one test prod on insulated brush holder and other on end frame. If test lamp lights, brush holder is grounded and should be replaced.

REPAIR

COMMUTATOR

Turning Down. Place armature in lathe then turn down to remove worn spots, out-of-round, rough or worn condition. Do not cut-off more than necessary. After turning commutator, check with dial indicator. Commutator must not be more than .001" out-of-round. If end of commutator segments are less than 1/16" wide the armature must be replaced.

Undercut Mica. Mica between segments must be below the edge of segment. Start groove with a small three-cornered file, then use hack-saw blade to undercut mica until it is 1/32" below the commutator surface. A "V" type undercut is not satisfactory. Use No. 00 sandpaper to clean and smooth up commutator, then use compressed air to remove all fine particles of cuttings.

ARMATURE

Welding Leads. When commutator riser bars are burned this is often caused by an open-circuited armature due to excessive output. When the bars are not too badly burned, the armature can sometimes be saved by rewelding the leads in the riser bars. After welding turn down the commutator and under-cut the mica until it is 1/32" below segments.

FIELD COILS

Insulation. If the insulation is worn so that the field wiring could become grounded, coil can sometimes be repaired by rewrapping. Rewrapping must be done with extreme care and neatness, as excessive wrapping may hinder reassembly.

Connections. If connections between coils are loose, resolder. Always use rosin flux when resoldering electrical connections -- NEVER USE ACID FLUX.

SEALS

Felt Type. Remove felt seal and seal retainer using punch to drive out of bearing retainer. Use file or stone to remove any metal staked over at time of installation.

Install felt seal in bearing retainer then press seal retainer, and seal in place. Press retainer until it is solidly in place. Use prick punch to stake retainer.

Lip Type. Use drift or punch to drive lip type seals from drive end frame and retainer.

Install new seal assemblies with lips of seals toward bearing. Position seals on end frame and

press with suitable replacing tool or drive seals into place with block of hard wood and hammer. Seals are properly positioned when edge of seals are flush with end frame.

REASSEMBLY

1. Install field coils and pole shoes in field frame (housing) and attach with pole shoe screws. Install "F" terminal in field frame, being sure it is properly insulated from field frame. Attach field coil ground wire to the field frame. If the field coil leads have been separated, they should be soldered and insulated.

2. Install bearing in drive end frame. Position bearing retainer and seal assembly against inside of drive end frame, using gasket between the two parts. Secure retainer to end frame with cap screws and lock washers. Thread soft wire through drilled head of screws to prevent loosening.

3. Apply small quantity of engine oil to leather seals and contacting surface of armature shaft. Install armature shaft through drive end frame, being sure that seals are not damaged. Install drive gear and secure with new self locking nut. IMPORTANT: Use torque wrench and tighten gear nut to 180 ft. lbs.

4. Position field frame over armature with drive end frame properly located against field frame. Install cap screws and lock washers then tighten alternately and evenly.

5. If commutator end frame has been disassembled it should be reassembled at this time. Be sure that brushes, brush holders and insulating washers are assembled in their proper position as noted at time of disassembly.

6. Install bearing in commutator end frame. Position bearing retainers to each side of bearing, using gaskets between retainers and end frame. Secure retainers to commutator end frame with cap screws and lock washers.

7. Apply small quantity of engine oil to felt seal and contacting surface of fan hub. Install armature shaft into commutator end frame bearing, being sure that felt seal is not damaged. Install cap screws and lock washers then tighten only finger tight until neutral point has been established.

8. Install fan to armature shaft, using Woodruff key. Install lock washer and fan retaining nut. Tighten nut securely.

9. Before installing generator, check as described under "Testing" earlier in this section, also adjust for neutral point in manner described in following paragraph.

NEUTRAL POINT ADJUSTMENT

Whenever generator has been disassembled, new brushes, armature or field coils installed, the neutral point must be adjusted. The neutral point refers to a particular relationship between the field poles, armature windings and brushes. When the relationship of these parts is correct, minimum arcing and best commutation and brush life will be obtained. All brushes must be properly seated with a brush seating hone before adjusting neutral point.

Adjustment is accomplished in the following manner: CAUTION: Adjustment of neutral point should be made as quickly as possible since armature will begin to heat. Do not allow armature to overheat.

1. Place generator on test bench, with armature free to rotate and without any connection to generator field terminal.

2. Connect a battery between generator "A" terminal and ground, and allow a current of 100 to 160 amperes to flow through armature. (Current may be controlled by variable resistance or by varying number of battery cells used).

3. Note tendency of the armature to rotate. The neutral point is found by shifting or rotating the commutator end frame into the position at which there is no tendency for the armature to turn in either direction.

4. When this position has been found the commutator end frame attaching screws should be tightened securely and locking washer tang bent over flat of bolt head.

SPECIFICATIONS

Make	Delco Remy
Model	1117601
Rotation (Viewed at Drive End)	Counterclockwise
Brush Spring Tension (Oz.)	25
Field Current @ 12 Volts @ 80° (Amps.)	6.0 - 6.85

COLD OUTPUT

Amperes	160
Volts	13
RPM (Approx.)	1650

SECTION 7-F
REGULATOR

Pages 175 - 184 - Service information in Maintenance Manual (Form X-4711) applies only to vehicles equipped with five unit, vibrating contact type generator regulator. Late model PD-3751 and all PD-4151 vehicles are equipped with a carbon pile type regulator. Service information covering this regulator is contained in the following pages.

CONSTRUCTION

The regulator, illustrated in figure 14 and covered in the following text, is a heavy-duty carbon-pile type. Although it is somewhat similar in outward appearance to 5 and 6 unit vibrating contact types previously used on coaches, it operates on a principal entirely different. Therefore it is important that the following text be carefully studied and thoroughly understood.

Both types of regulators - namely the vibrating contact type previously used, and the carbon-pile type covered by this text - serve the same purpose (1) to limit voltage and current (2) to connect or disconnect generator and battery as generator output varies.

With the carbon pile regulator, the field current is controlled by a carbon pile rheostat inserted in the field circuit. Therefore, the field circuit is not interrupted, and any amount of field current can be handled, provided the unit is made large enough and has sufficient heat-radiating capacity. Heat generated in the rheostat by its continuous operation is dissipated directly into a radiator on the outside of the box.

The carbon pile rheostat itself consists of a stack or pile of small flat carbon disks inside a ceramic tube. Resistance of the stack varies with the amount of pressure on the disks, decreasing as the pressure is increased. Throughout the working range of the regulator, the change in length of carbon pile does not exceed .003 inch.

VOLTAGE AND CURRENT REGULATORS

The voltage regulator (fig. 14) is wound with many turns of fine wire and is connected in shunt (fig.15) across the generator. The current regulator (fig.14) is wound with a few turns of heavy wire and is connected in series (fig. 15) with the generator output.

When the voltage or the current tends to exceed the adjusted value, the increased pull of the electromagnet reduces the pressure on the carbon pile disks, thus increasing their resistance and reducing the voltage or the current, depending on which regulator is called upon to function. Under a steady condition of speed and load, the regulator assumes the position required to furnish the proper resistance and remains static as long as this condition exists. This characteristic tends to prolong the useful life of the carbon pile regulator.

The very small change in length of the carbon pile during operation is necessary to prevent uneven operation which might otherwise result in over-control. It is also necessary to use a special spring which closely matches the pull of the electromagnet over the whole range of movement. The effect of surges is partially nullified and stability is improved by a small oil-filled dash pot which acts much like a shock absorber on the movements of the armature of the electromagnet.

VOLTAGE RHEOSTAT

In addition to the current and voltage regulators, a small rheostat is included in the control portion of the regulator. This rheostat, called the system voltage rheostat (fig.14) is connected in series with the electromagnet of the voltage regulator. By adjusting this variable resistance, the voltage setting can be raised or lowered within a range

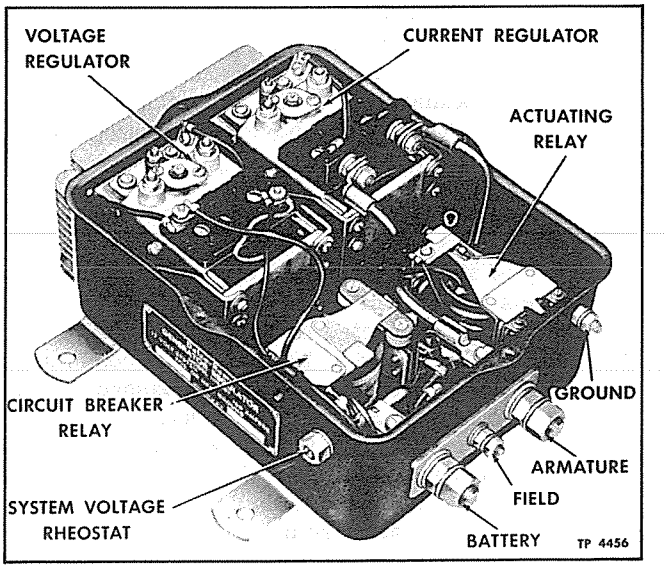


Figure 14—General View of Regulator

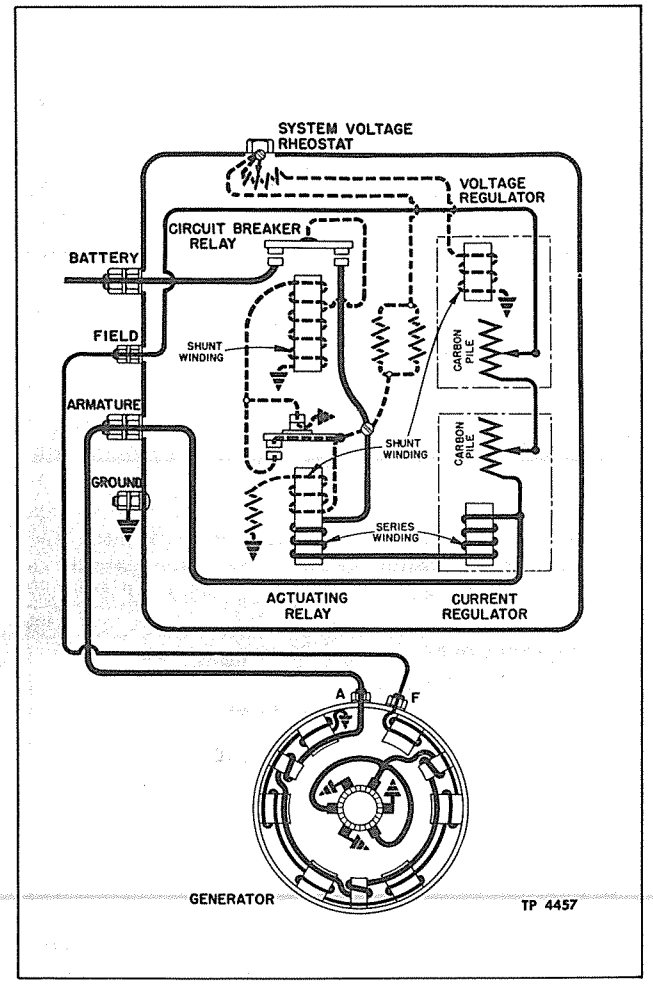


Figure 15—Generator and Regulator Wiring Diagram

of approximately 3 volts. The system voltage rheostat is mounted on the box so that it can be adjusted from the outside. This design offers a quick means of adjusting the system voltage (within approximately 3 volts) without removing the cover or changing mechanical adjustments of the units.

ACTUATING AND CIRCUIT BREAKER RELAYS

The actuating relay (fig. 14) contains two windings and two sets of contact points. One of the windings is a series winding of a few turns of heavy wire (fig. 15) which is connected into the charging circuit. The second winding is a shunt winding consisting of many turns of fine wire (shown in dashed lines) which, in series with a resistor, is shunted across the generator. One or the other set of points is always closed except when the armature is in motion between the two extreme armature positions.

The circuit breaker relay (fig. 14) contains a shunt winding (fig. 15) on a core above which is an armature with two heavy contact points. Beneath the two upper points are two stationary points, one of which is connected through the actuating relay and current regulator to the "Armature" terminal, and thence to the insulated terminal of the generator. The other point is connected direct to the regulator "battery" terminal and thence to the battery through the wiring circuit.

When the generator is not operating, the actuating relay armature is held in the upper position by tension of spiral spring therefore the upper points are closed and the lower points are open. When the generator begins to operate or charge a magnetic field builds up in the actuating relay shunt winding. When the voltage reaches the value for which the relay is adjusted, the magnetism is sufficiently strong to pull the armature down toward the core, causing the upper contact points to open and the lower contact points to close.

Closing of the lower contact points connects the circuit breaker relay shunt winding (fig. 15) across the generator. This creates a strong magnetic field which pulls the circuit breaker relay armature down so that its points close. This completes the circuit between the generator and the battery.

When the circuit breaker points have closed, the major part of the winding is shunted across the generator by means of a connection to the relay armature. This manner of connecting the winding assures better relay operation, since any shock or vibration which might cause the actuating relay points to bounce open will not cause the circuit breaker relay point to open as long as the actuating relay upper contact points do not close.

When the generator voltage drops below battery voltage, current flows from battery to the generator. This reverses the flow of current through the actuating relay series winding. As a result, the series winding and the shunt winding no longer assist each other but become magnetically opposed. The resultant magnetic field becomes too weak to hold the actuating relay armature in the lower position. The armature spring tension opens the lower points and closes the upper points. The upper points in closing connect the insulated end of the circuit breaker relay winding to ground. With the circuit breaker relay points still closed, battery current entering the winding flows to ground in opposite direction. This causes the upper part of the circuit breaker relay shunt winding to magnetically oppose the lower part so that the resultant magnetic field becomes too weak to hold the circuit breaker down. The armature is released and spring tension opens the points. This design of the relay provides rapid and positive relay action.

REGULATOR CHECKS AND ADJUSTMENTS

The following checks and adjustments cover only those operations which can be performed while unit is mounted on the vehicle. Certain other adjustments should be performed when unit is completely rebuilt, however, since the scope of these instructions do not cover complete overhaul, they have been omitted at this time, also complete overhaul data is not available at this time.

NOTE: Because of high current controlled by this regulator, it is necessary to use insulated tools when making adjustments, since short circuits may seriously damage the regulator. A non-magnetic feeler gauge must be used in checking the air gaps of voltage and current regulators because of the strong magnetic fields created during their operation. Gauges may be made of brass or stainless steel.

CIRCUIT BREAKER RELAY

CLOSING VOLTAGE CHECK

With generator inoperative, connect a volt meter between regulator "armature" and "ground" terminals. Disconnect lead from "field" terminal on regulator and connect a 25 ohm 25 watt variable resistor in series between lead and "field" terminal. Generator can now be controlled by changing the variable resistance - increasing the resistance to lower voltage or decreasing resistance to raise voltage.

Before starting generator remove the main fuse or disconnect battery lead at "battery" terminal on regulator. Operate generator at about 2500 rpm with full resistance in variable resistor previously connected into field circuit. Hold actuating relay armature down by hand so that lower contact points are kept closed during entire check. Gradually raise generator voltage by decreasing variable resistance until circuit breaker contact points close. Note closing voltage. If necessary to make a second check, reduce generator voltage by increasing resistance until voltage is reduced to 4 volts or less. This is necessary to reduce errors caused by residual magnetism.

CLOSING VOLTAGE ADJUSTMENT

Adjust closing voltage, if necessary, by turning adjusting screw (fig. 16)at base of relay frame. Closing voltage is increased by increasing spring tension or lowered by reducing spring tension.

ACTUATING RELAY

CLOSING VOLTAGE CHECK

With generator inoperative, connect a voltmeter between regulator "armature" and "ground" terminals. Disconnect lead from "field" terminal on regulator and connect a 25 ohm 25 watt variable resistor in series between lead and "Field" terminal. Generator voltage can now be controlled by changing the variable resistance -- increasing the resistance to lower voltage or decreasing resistance to raise voltage.

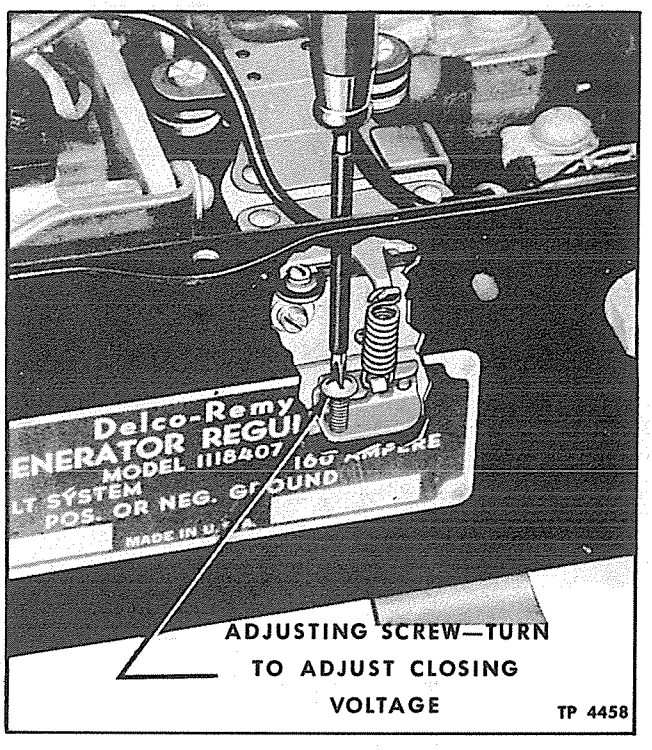


Figure 16—Circuit Breaker Relay Closing Voltage Adjustment

Before starting generator remove the main fuse or disconnect battery lead at "battery" terminal on regulator. Operate generator at about 2500 rpm with full resistance in variable resistor previously connected into field circuit. Hold actuating relay armature down by hand so that lower contact points are kept closed during entire check. Gradually raise generator voltage by decreasing variable resistance until circuit breaker contact points close. Note closing voltage. If necessary to make a second check, reduce generator voltage by increasing resistance until voltage is reduced to 4 volts or less. This is necessary to reduce errors caused by residual magnetism.

CLOSING VOLTAGE ADJUSTMENT

Adjust closing voltage, if necessary, by turning adjusting screw (fig.17) at base of frame, Closing voltage is increased by increasing spring tension or decreased by decreasing spring tension.

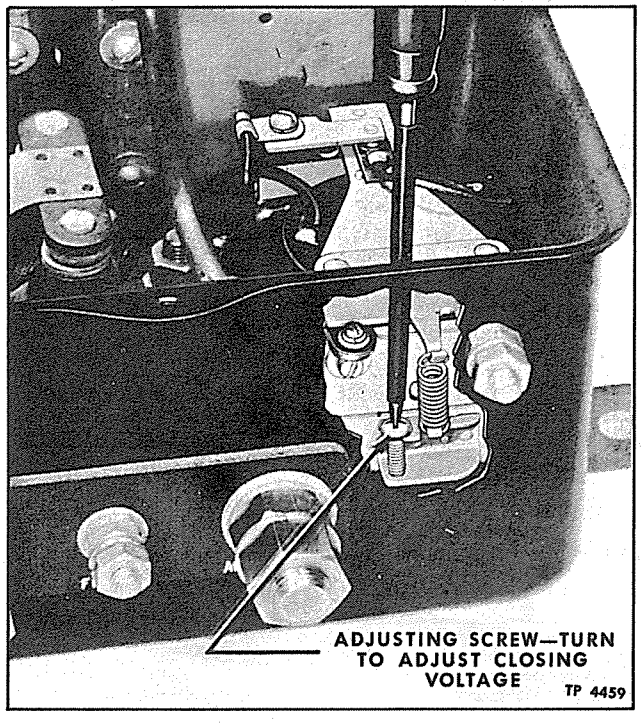


Figure 17—Actuating Relay Closing Voltage Adjustment

VOLTAGE REGULATOR

VOLTAGE SETTING

1. Connect test voltmeter between regulator "armature" and "ground" terminals.

2. Set system voltage rheostat (fig. 18) on side of regulator to halfway position. The halfway position is located by turning slotted screw to right and left as far as possible, marking these limits with pencil, then returning screw to mid-point between these marks.

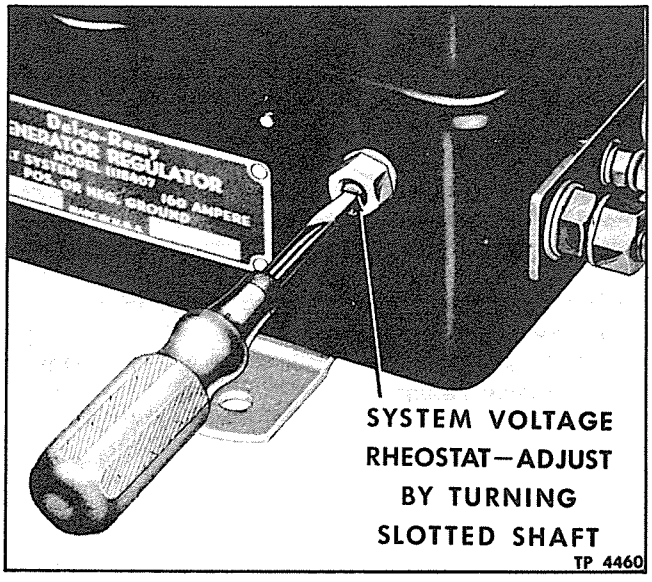


Figure 18—System Voltage Adjustment

3. Disconnect lead and regulator "field" terminal and connect a 25 ohm 25 watt variable resistor in series between "field" terminal and lead. Set variable resistor to maximum resistance.

4. Operate generator at approximately 2500 rpm. Gradually reduce resistance of variable resistor until it is completely cut-out or until generator voltage reaches approximately 14 volts.

5. Slowly loosen voltage adjusting nut "A" on voltage regulator (fig. 19). As nut is loosened, generator voltage will fall. Loosen only until voltage stops falling. Further loosening may allow spring to become unhooked, requiring complete disassembly to reinstall.

6. Gradually tighten voltage adjusting nut "B" until voltage reaches 8 to 9 volts.

7. Tighten voltage adjusting nut "A" slowly until voltage reaches 14 volts.

8. Reduce generator voltage to 4 volts or less by increasing resistance in variable resistor in field circuit. Raise voltage again by gradually reducing resistance in variable resistor until it is completely cutout. This will permit the circuit breaker relay to close and the voltage to stabilize. Note voltage setting.

9. Check front air gap (fig. 20) of voltage regulator, using non-magnetic feeler gauge.

10. Adjust air gap, if necessary, by loosening the lock nut then turning stack adjusting screw (fig. 21). Tighten lock nut when correct adjustment is obtained.

11. Recheck voltage setting as previously instructed in Step 8. Adjust nuts "A" and "B" equal amounts until voltage reaches specified value.

12. Turn slotted screw of system voltage rheostat (fig. 18) to extreme left and then to extreme right and note if voltage varies smoothly in both directions. (If voltage varies unevenly or erratically, rheostat is faulty and should be replaced). Turn screw back until voltage is again at specified value. System voltage can be adjusted within a range of approximately 3 volts, if necessary, without changing any mechanical adjustments or removing cover of regulator.

CURRENT REGULATOR

The following checks and adjustments are made with regulator cover removed but battery disconnected.

CURRENT SETTING AND FRONT AIR GAP

1. Disconnect battery lead at "battery" terminal of regulator. Connect test ammeter and .06 ohm 3000 watt fixed resistor in series between "battery" terminal and "ground" terminal. Connect volt-

meter between "Armature" and "ground" terminals of regulator.

2. Disconnect lead from "field" terminal of regulator and connect 25 ohm 25 watt variable resistor in series between lead and "Field" terminal. Set variable resistor at point of maximum resistance. Generator voltage cannot be controlled by changing variable resistance.

3. Run engine up against governor so that generator operates at maximum speed. Gradually increase generator output by decreasing resistance of variable resistor in field circuit until it is completely cutout.

4. Slowly loosen current adjusting nut "A" on current regulator (fig. 19). As nut is loosened generator output will fall. Loosen only until output stops falling. Further loosening may disconnect tension spring from adjusting screw, thereby necessitating complete disassembly of unit.

5. Tighten nut "B" gradually until output reaches approximately 90 amperes.

6. Tighten nut "A" slowly until output reaches 150-160 amperes (voltage should not exceed 12.5 volts).

7. Check front air gap with non-magnetic feeler gauge (fig.20). Adjust front air gap if necessary by loosening lock nut and turning stack adjusting screw (fig.21). Set lock nut when adjustment is completed.

8. Reduce output by gradually increasing the resistance of variable resistor in field circuit to maximum point. (Voltage must be 4 volts or less). Slowly raise output by decreasing variable resistance until it is completely cut-out and current stabilizes at maximum point. Note current setting.

9. If necessary, adjust current output to specified value by tightening or loosening nuts "A"

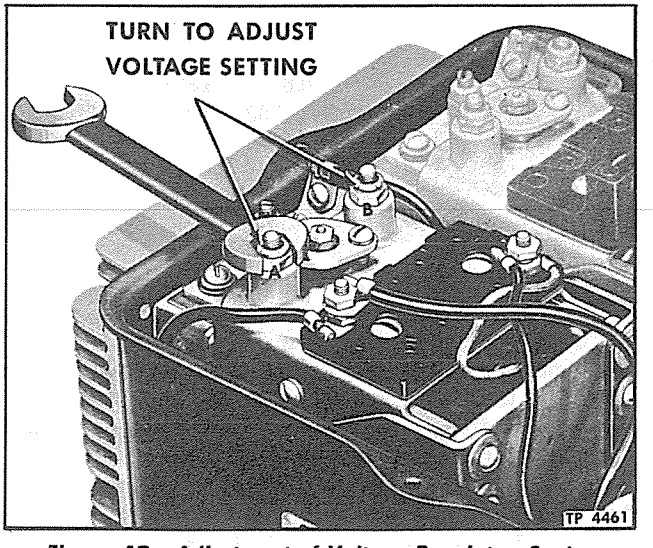


Figure 19—Adjustment of Voltage Regulator Setting (Current Regulator is Adjusted in The Same Manner)

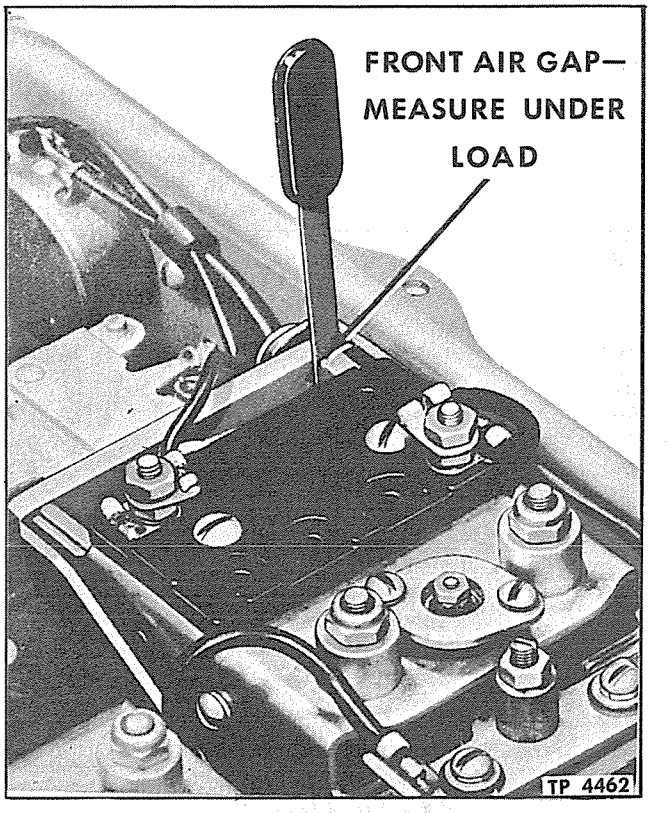


Figure 20—Voltage Regulator Front Air Gap Check Current Regulator Air Gap is Checked in The Same Manner

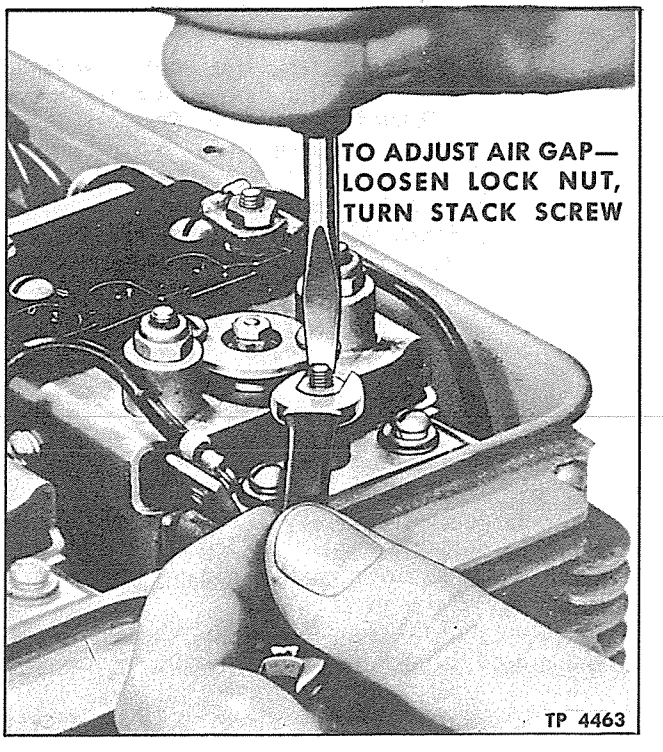


Figure 21—Adjusting Front Air Gap on Voltage Regulator (Current Regulator Air Gap is Adjusted in Same Manner)

and "B" in equal amounts as required. Check final current setting by lowering and raising output as previously described in Step 8.

NOTE: It is extremely important that voltage and current output be reduced to the values given in making these tests and then raised gradually. Otherwise, residual magnetism in the units will cause serious errors in the settings.

POLARITY

When generator or regulator wires have been disconnected, especially when new unit is being installed, generator must be polarized after units are installed -- BEFORE ENGINE IS STARTED. Failure to polarize generator will cause regulator points to vibrate excessively and burn, Remove wire from "field" terminal at regulator. Momentarily touch wire removed from "field" terminal to "battery" terminal of regulator. This connection allows a momentary surge of battery current to reach generator field windings which automatically gives generator the correct polarity with respect to battery it is to charge. Reconnect wire to regulator "field" terminal, then tighten terminal nut securely.

SPECIFICATIONS

MAKE	Delco Remy
MODEL	1118407
Actuating Relay	
Back Air Gap	.015"
Top Air Gap	.036" - .041"
Upper Point Opening	.025" - .030"
Closing Voltage (Hot or Cold)	12.7 - 13.2
Circuit Breaker Relay	
Back Air Gap (Armature Against Core)	.005" - .010"
Top Air Gap (Points Just Touching)	.030" - .035"
Point Opening	.040" - .050"
Closing Voltage	6.5 - 7.5
Sealing Voltage	8.5 - 10.0
Voltage Regulator	
Front Air Gap (At Rated Voltage)	.022"
Back Air Gap (Armature Loaded and Parallel to Ground Surface of Frame)	.016" - .018"
Voltage Setting (Hot)	14.0
Current Regulator	
Front Air Gap (At Full Load)	.022"
Back Air Gap (Armature Loaded and Parallel to Ground Surface of Frame)	.016" - .018"
Current Setting	150 to 160 Amp.

SECTION 12-A
FUEL SYSTEM

Pages 201 - 208: Fuel Filler Signal.

Late production vehicles will be equipped with a signaling device mounted at top of fuel tank, which is designed to signal attendant when tank is filled to "full" level.

Signaling unit creates an audible whistle which is transmitted through a vent to exterior of vehicle where it may easily be heard by attendant.

Two types of signals are used. Whistle may start shortly after starting to fill tank and continue until tank is filled; or whistle may not start until tank approaches capacity then continue until tank is filled. In either case DO NOT FILL TANK AFTER WHISTLE STOPS.

SECTION 13
LUBRICATION

Pages 209 to 214: Lubrication information and Lubrication Chart contained in Maintenance Manual (Form X-4711) is applicable to all PD-3751 and PD-4151 vehicles, except as noted in the following items.

Item 16

Change quantity of lubrication fittings from "three" to "four."

Item 28

When generator Model #1117601 is used this item can be eliminated, since no air cleaner is used.

Items 38 and 39

These two items are not used on vehicles equipped with Variable Pitch fan blades. Therefore, no service is necessary.

SECTION 15
SPRING SUSPENSION

Pages 215 - 222: Service information in this section applies with one exception.

On some PD-3751 and PD-4151 coaches a tapered spacer and seal are installed, between front axle center and front spring assembly, to provide correct axle caster.

When replacing a spring, on vehicles which have tapered spacers installed, note position of spacer when spring is removed from front axle. Install spacer in position noted when spring is reinstalled on axle. If spacer is not installed properly, front axle caster will be incorrect.

SECTION 17
TRANSMISSION

Pages 235 - 254: Late model PD-3751 and all PD-4151 coaches are equipped with Spicer Model 7141-A transmissions. All references to Spicer Model 7141 transmission in text of current manual (Form X-4711) should be disregarded.

SPECIAL TOOLS (Page 252)

Tool number of Mainshaft Rear Bearing Nut Wrench (CS-1075), has been changed to CS-1072.

CS-1128 - Bearing Retainer Puller is not required to service the 7141-A model transmission.

SECTION 19-A
HUBS AND BEARINGS

Pages 259 - 262: All PD-4151 vehicles are equipped with rear hubs and bearings of the type designated as "Late Vehicles" in figure 2, page 260, in Maintenance Manual X-4711.

Therefore, when servicing rear hubs and bearings on PD-4151 vehicles, use only that service information in Maintenance Manual X-4711 which applies to late vehicles.